SCIENTIFIC AMERICAN

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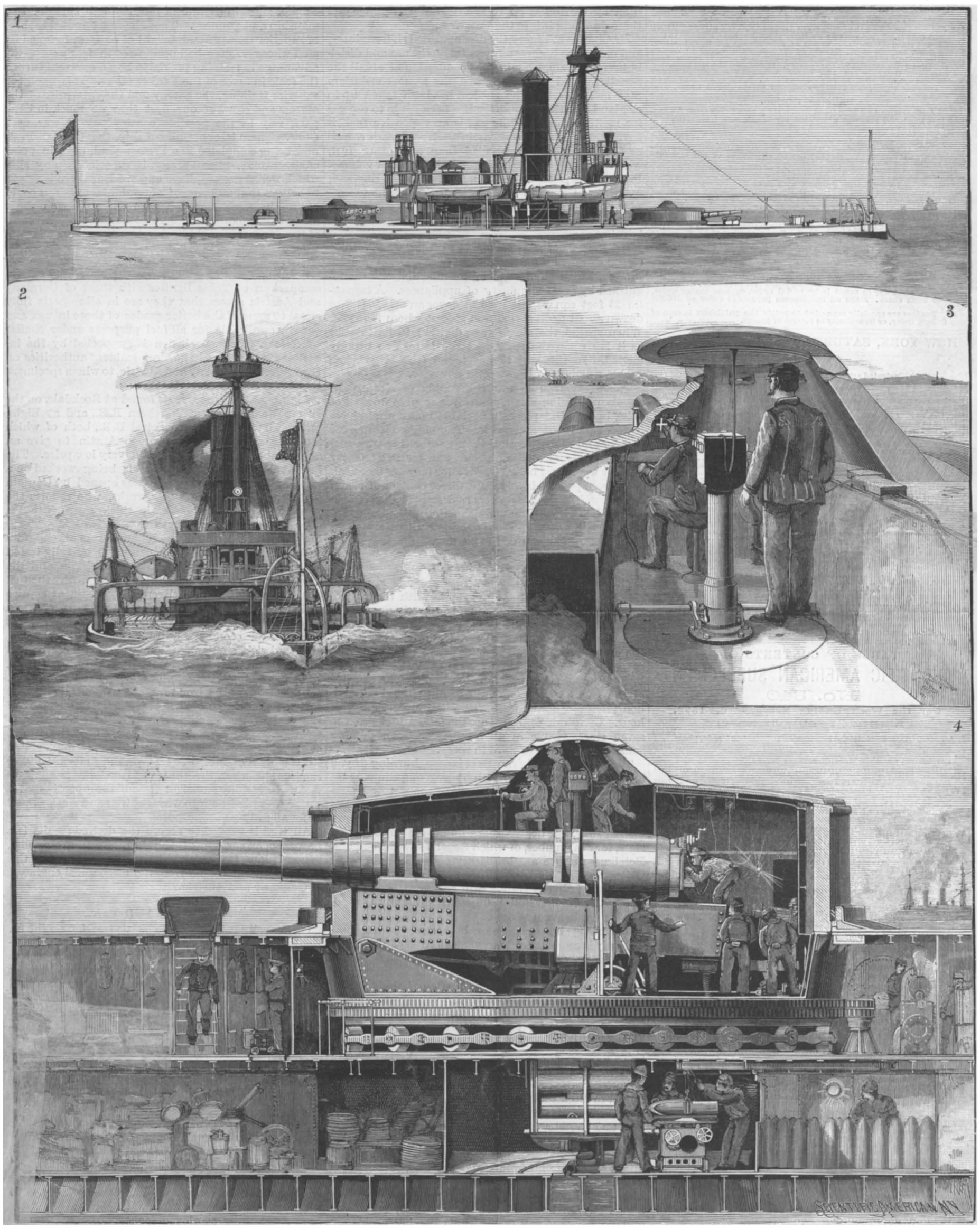

1. Side view of the Miantonomoh. 2. The Miantonomoh under headway. 3. Interior of conning tower. 4. Cross section of turret and hull.

THE NEW AMERICAN WAR STEAMER MIANTONOMOH.—[See page 85.]

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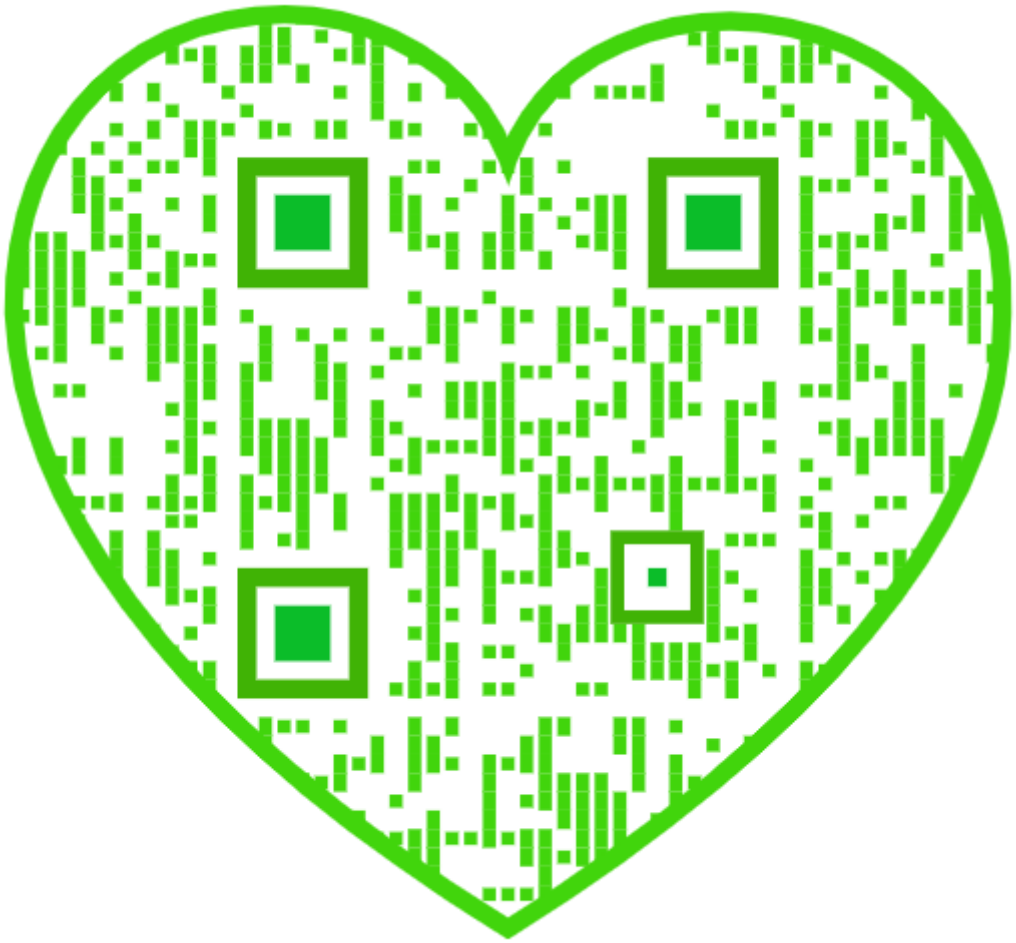

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REMOVAL OF SNOW BY MELTING.

The subject of disposing of snow which has fallen in the streets by some more rapid and less cumbrous method than that of carting it away has attracted considerable attention from time to time. Various systems of melting it have been proposed, and calculations as to the thermal energy required indicate the practicability of so doing. As fast as melted the water could be run away through the sewers. The calculations were made and the possible economies of the process were examined into, and the results were published some years ago in these columns. It appeared that snow could probably be more economically disposed of thus than by carting it off to the distant river edge and there dumping it into the water.

Mr. Charles E. Emery, the distinguished civil engineer, and one of the highest authorities on the use and distribution of steam, examined the question at about the period alluded to, and reached the same conclusion. Still more recently the subject has been taken up in England and the proposition has been made to use gas for melting snow. While gas is an expensive fuel, it develops a definite economy in use, because it can be more advantageously applied than any other fuel, where the center of heating is of limited area or volume. Putting the price of gas at a fair figure for England, 2s. 6d. per thousand cubic feet, an English contemporary, *The Building News*, concludes that snow could be very advantageously disposed of by melting with burning gas.

Mr. Emery did not examine the subject from a theoretical standpoint only. He also tried a steam melting process, which gave excellent results and was distinguished by great simplicity of appliances. A tarpaulin 25 feet square was used to cover an area. It was drawn about upon a sled and spread where required. When spread, the steam was admitted to its interior as it lay upon the snow, and the latter was rapidly melted. In this way it was found that large areas could be denuded of snow with economy.

The great trouble was the supply of steam. In streets possessing steam mains this trouble would not exist, but in other places a portable boiler would have to accompany the apparatus. The method seems far simpler and more practical than gas melting with special burners and melting plates, and for this country at least would, we believe, prove far more economical. The steam process involves the direct contact of steam and snow. In the gas process as described the conduction of heat through a metal heating plate is also involved, which would be a cause of inefficiency and would retard to a degree the melting.

THE EVENING SKY.

The early evening sky just now presents a spectacle of uncommon beauty. Sweeping with the eye upward from the western horizon, the lovely crescent of the new moon meets the view; next, the brilliant orb of Venus, gleaming with golden splendor; higher up is the refulgent globe of Jupiter, the largest of the planets, the fastest in circumferential motion, attended by four moons, visible in the telescope. The exterior of the earth turns at the rate of a thousand miles an hour; that of Jupiter, twenty-seven thousand miles an hour. Continuing upward are the fabled Pleiades, the seven stars, visible in all lands—a cluster of flaming suns, forever flying onward in space.

The rosy red Aldebaran next is seen, burning (if you look in the spectroscope) with hydrogen, sodium, magnesium, calcium, iron, tellurium, antimony, and mercury. Looking eastward, that wondrous constellation Orion is beheld, with his three-starred belt, three equidistant suns, one degree apart, and those more distant stars, four in number, of which Regel below the belt and Betelguese above are brilliantly conspicuous. Below Orion, toward the east, shines the majestic Sirius, brightest of all the stars. Still eastward is Procyon, above it Castor and Pollux, Capella and Algol, all prominent in the heavenly dome.

Astronomy is indeed the sublimest of the sciences; no study is more interesting, none more elevating to the soul; yet how few pursue it! Probably less than one in ten thousand persons can recognize or name the principal constellations. The glories of the heavens pass by unnoticed and unknown.

THE WAR SHIP AND HER CREW.

The relative possible effectiveness of modern war ships may be measured by comparing the strength of armor, of battery, power of engines and the like, the one with the other. But other factors must be determined in order to come to anything like a reliable conclusion as to the result of an engagement between one type and another, to wit, the experience and training of officers and crew, and their familiarity with the apparatus they handle; else the opposing commanders might come together before engaging and, sitting down at a table, with pencil and paper before them, calculate the chances and award the victory without firing a gun. Given two ships of equal armor, armament and power, who will doubt that, barring accidents, the one whose crew is quickest and surest at the gun practice, whose officers are quickest at maneuver, will win? So, too, of ships unequal in size and armament. The most powerful will not necessarily have the advantage.

It is an axiom among boxers that a good big man is better than a good little man, but that a clever little man is better than a sluggish big man. On the same theory a big ship, however heavily armored and armed, with unskillful officers and men not used to or slovenly at the guns, would be no match for a much smaller craft with less powerful guns but officers well schooled, energetic and enterprising, and a crew well drilled and handy. Those who have read the naval history of the United States will recall the victories gained by the Yankee ships in the war of 1812, through superior seamanship and gunnery. Though often opposed to ships of superior tonnage and weight of battery, manned by men whose courage had been tried in many seas, the advantage in training proved to be a factor that turned the scale in favor of the Yankee crews. It is upon the superior training, the energy and the enterprise of the officers and crews of our fleet that we must, in large part, rely in the possible contingency of war with Chile. There is one Chilean ship, the Capitan Prat, now being completed in a French yard, that, in point of size, armament and armor, is superior to any ship which we, at present, have afloat. But there is reason to believe that any one of several of our ships could profitably engage her, for, with such a crew as she is likely to get, nothing like the maximum effectiveness of her apparatus could be developed.

Texas Lignite.

According to Professor E. T. Dumble, a very careful comparison of Texas lignites with those of Germany and Austria shows that they are in all respects fully equal to some of the better grades of those in use, and equally applicable for all fuel purposes under similar conditions. This conclusion is supported by the indorsement of some of the most eminent authorities on the subject in Germany and Austria, to whom specimens were submitted for examination.

Lignite of this character is found at Rockdale, on the International & Great Northern R.R., and at Elgin, on the Houston & Texas Central R.R., both of which localities are sufficiently near to Austin to give an abundant supply of the fuel at a very low price. The bed at Rockdale is open, and is being worked on a small scale; that below Elgin was opened by Captain Mather, of the Austin water works, who reports the seam to be about eight feet in thickness and that it was similar in all respects to that at Rockdale. Taking into consideration the character of the lignite which occurs at Rockdale, which has been fully tested by the geological survey, and that at Elgin, and the extent of these deposits, there is no reason why the fuel cannot be mined and delivered in Austin at a price which will make it the cheapest of the cheap fuels; and its quality is such that it can be used with greatest success and economy in the manufacture of lime, cement, brick, stoneware, glassware, pottery, etc., and under steam boilers of every kind, thus being entirely suited to all the manufacturing needs of Austin.

In developing the iron resources of central Texas it will be possible to use some of these lignites as part of the fuel of the smelting furnace. The character of coke which can be made from them is now the subject of experiment, but it is too early to make any definite statements regarding it. Outside the first smelting of the iron, however, the quality of the lignites adjacent to Austin is fully sufficient for all the operations for converting pig iron into wrought iron and steel, as well as for all rolling mill purposes.

All that is needed to secure the desired results is a proper construction of the fire boxes, grate, etc., general plans for which can be secured through this department, or directly from the mechanical engineers of Germany and Austria.

An Electric Mail Car.

One novelty in the way of electric traction on the St. Louis and Suburban Railway, now in successful operation in St. Louis, Mo., is the application of electric motors to a United States mail car, which makes regular trips over the entire line, distributing and collecting the mail at the different railway stations, as is done on steam railways. This car is of the same length as an ordinary steam railway mail car, and is equipped with double trucks with 36 inch wheels, a Thomson-Houston motor of 15 horse power capacity being connected to each truck. A very high speed is attained, and the delivery and collection of mail is made without stopping the car, as in steam service.

AT Fagersta, in Sweden, briquettes are now being manufactured out of wood charcoal by the addition of coal tar. A paste is made out of the charcoal and the tar, which is transferred to a press, whence it issues in slabs about 16 in. thick, which are exposed to the air on the ground for several weeks, during which period the water in the tar evaporates. This combustible has been successfully employed for steam boilers, its calorific power being said to approach that of the best English coals.

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An Englishman's Views on the Great Exposition.

Mr. James Dredge, editor of *Engineering* and British commissioner, visited this country not long ago to examine and report to his government upon the condition and prospects of the Chicago Exposition. Recently he read an able and exhaustive paper before the Society of Arts, in London, which is full of instructive particulars relating to the great enterprise. The following are his concluding remarks:

I hope I have made it clear that the pre-eminence of the Columbian Exposition may be fairly claimed by its organizers, not only because it will be far larger than any international exhibition that has preceded it—that is simply a law of natural development—but because of the real beauty and grandeur of its buildings, and, I think, because of the greater variety, novelty, and interest of its contents. The development of industry in the United States has advanced at such a prodigious rate of late years that no one can form even a faint idea of its present condition, except by facts and figures, than which nothing is more misleading. Last year I ventured to suggest several reasons why this exhibition should be truly international, and to-day I find no reason to modify the opinions I then expressed. On the contrary, many significant facts combine to prove the correctness of those views, and that they were not overstated, at all events, so far as this country is concerned. There is a very general feeling of resentment against the United States, because she surrounds her industries with a high barrier of tariffs. Nothing could be more unreasonable than this resentment; it is the business of every country to guard its welfare in the way which seems best to itself, whether by great armies, powerful navies, or internal policy. And, in spite of all the impediments placed in the way of our industrials, no less than one sixth of our total exports find their way through the protected ports of North America. This vast volume of trade is carried on to the mutual benefit of sellers on this side and of buyers on the other side of the Atlantic. It seems to me that among these great interests involved, there would be enough to occupy all the space that has been assigned to us at the exhibition. Again, we have many special industries, the products of which are of the luxurious and costly kind, to acquire which is the privilege of wealth; and there is no country in the world that can compare with the United States in the number and capacity of such purchasers. This should prove a sufficient inducement to many manufacturers who may become exhibitors at Chicago, with every reasonable certainty of selling all that they may send, and of establishing permanent and profitable connections in the future. Americans are rapidly becoming leading patrons of art. The fact that most art students from the United States go to Paris to study is probably the reason why the French school controls the American market. It is time that this condition of things is changed; and there is little doubt that it will be changed, if English artists respond to the invitation to exhibit, and are fitly represented in the noble gallery of fine arts that will form so conspicuous a figure at the Chicago exhibition. English sentiments will remain deeply implanted in American nature, and will respond freely to the feelings expressed by the noble English school, which won so much admiration and surprise at the Paris Exhibition of 1889.

I have pointed out that it is the avowed intention, in American official quarters, to make a bold stroke at our South American trade, and to wrest from us as much of our commerce in the western southern hemisphere and elsewhere as may be possible. Being forewarned of this approaching struggle, which is without unfairness and without bitterness, our manufacturers should be forearmed, and, by carrying the war into our commercial enemy's camp, should turn the exhibition to their advantage, and prove to all the world the incontestable superiority of the goods which we export, both as regards quality and price. Whatever benefits the United States may derive from the policy of high tariffs, it is certain that such complete protection must act prejudiciously on many industries, both as regards the quality of the goods produced and the cost of producing them. This is an inevitable consequence of the absence of the healthy stimulus of competition. When, therefore, foreign purchasers have an opportunity of comparing at Chicago the relative values of our own goods, side by side with similar articles made in the United States, I think there need be little fear of the result. Of course, this has not a universal application; we cannot expect to hold the lead in every branch of manufacture, and it must be frankly admitted—and admitted, I hope, with due admiration of American ingenuity, skill, and enterprise—that in many things the United States have left us far behind. Any attempt at competition in those directions would, of course, be useless, and only lead to disappointment and loss of money.

Another important inducement to manufacturers to be present at Chicago must not be lost sight of. The number of Americans visiting Europe increases year by year; for the most part they are wealthy and leave large sums of money behind them, and, fortunately for our trade, England is rising in favor with these visitors. Many shopkeepers and manufacturers enjoy great support from American customers, and it would be bad policy for them to neglect the means which will be afforded them in 1893 for increasing this support and making new connections. Exhibitors of such goods as the wealthy American tourist loves to buy will be remembered long after the exhibition has been closed, and will be sought for in England by visitors who will remember their displays at the exhibition.

To the horticulturist, the coming exhibition affords the certainty of a rich harvest, for as it has already been pointed out, our pre-eminence in flower culture is undisputed, and this branch of industry is less hampered by tariff obstacles than most others.

Much machinery of varied classes may be exhibited with profit, chiefly for the benefit of foreign customers, but in some cases also to meet the demands of the American market. A large exhibit of objects connected with transportation—such as railway rolling stock and ship models—may be confidently expected; these would be shown, not with the expectation of any actual trade benefit, but for the information of Americans who sooner or later will visit Europe. With a more direct purpose, the manufacturers of bicycles and tricycles may be expected to attend, for they represent a very important industry, in which this country takes an undoubted lead. Patentees of machinery and of processes may, if their exhibits possess real merit, fairly hope to do business in the United States, and our most advanced steam engine practice will certainly be represented there on a large scale. Altogether, one way and another, we may fairly hope that the area allotted to us in the Machinery Hall will be filled with representative exhibits, and that the displays in the Electricity and Mining Building will not be unworthy of the country. As regards agricultural exhibits, American manufacturers have taken so decided a lead in the implement trade that there appears but a slender chance for the British exhibitor in America; but the classification in this department is so wide and varied that it embraces many objects in which we can be represented with profit; especially is this the case with live stock for breeding purposes, for which there is always a demand in the United States, and an exemption from duty.

To urge manufacturers to incur the trouble and expense of exhibiting at the Chicago Exhibition, on the merely sentimental ground of aiding in the triumph of a great work, would be absurd, although there are idealists on both sides of the Atlantic who see in the general advancement of humanity sufficient reason for demanding on the part of others large pecuniary sacrifices. But an exhibition can only be successful as a commercial enterprise, and any manufacturer would be as foolish to participate without reasonable prospect of benefit as he would be to abstain from mere prejudice against the tariff. Let our manufacturers consider, therefore, carefully before deciding; they can obtain sufficient data from which to form a fair appreciation of the chances of profit or loss, and if the odds are in favor of the former, they may go to Chicago, certain of a reception they have never experienced before at any international exhibition; a reception based on true generosity and friendship, from a nation speaking their own language, bound to them by ties of kinship, and by community of sentiment; competitors only so far as competition is inseparable in the struggle for pre-eminence.

Resinized Silver Paper.

The particular method of preparing the paper recommended by Herr Valenta is as follows: Ten parts of chloride of ammonia are to be dissolved in one hundred parts of water; from three to four parts of gelatine should be swollen in water. To prepare the saponified solution of resin, some water is heated to boiling point in a porcelain dish, and some solution of ammonia added, and the light yellow French resin, finely powdered, added in small quantities, with constant stirring. When all the resin is saponified and the solution quite clear, the swollen gelatine is added and dissolved, the solution of chloride of ammonium is now added, and the bulk of the solution made up to one thousand parts with distilled water, carefully neutralized with dilute hydrochloric acid; and finally a concentrated solution of citric acid added till a strong acid reaction is given. The resin is precipitated in a very fine state of division by the addition of the acid, and a milky liquid thus obtained, which is used to salt the paper with.

Rives paper gives the best results, and it is best salted by spreading the warm solution over the paper with a pad, and then allowing it to float on the warm solution for three minutes. The salted paper should be dried in a fairly hot room. Sensitizing may be effected as usual by floating on a 50 or 60 grain silver solution for two to three minutes, and then drying in the dark.

The paper should be fumed for ten minutes before use, as greater brilliancy and quicker printing is thus obtained. The prints, when removed from the printing frame, have a dark-blue, violet shade, and if washed slightly and then fixed in an acid fixing bath, a pleasing reddish-brown tone results. The prints are not sunken in, and possess much greater brilliancy and purer whites than ordinary salted paper prints.

Beautiful black prints may be obtained by the following procedure, and they closely resemble good platinotypes. The prints must be well washed to free from nitrate of silver, immersed in a bath of gold chloride 1 part, borax 80 parts, water 10,000 parts, till they assume a deep violet tone when examined by transmitted light. They should be then washed and placed in a platinum bath, composed of 1 part chloroplatinite of potash, 300 parts of water, and 15 to 20 drops of hydrochloric acid. They tone very quickly to a fine black, and should be then well washed and fixed. It is essential to print very deep for this platinum toning.

If the prints are fixed on removal from the gold bath, the image on drying is a good reddish-black, and if an acid uranium nitrate bath be substituted for the gold and borax bath, a fine red tone is obtained.—*Amateur Photographer.*

The Crushing Resistance of Bricks.

The Department of Experimental Engineering, Sibley College, recently received from an Ithaca manufacturer four samples of brick to be tested. All the brick were tested entire and on edge, as they would be used for the purpose of paving. The sides were dressed to parallel planes on an emery wheel, so that the bearing should be uniform over every part. A single layer of thick paper was placed between the surfaces of the brick and the testing machine.

The repressed brick exhibits the greatest crushing strength of any brick on record; it is also superior in strength to sandstone, and fully four-fifths as strong as granite. The tests of stone are usually made on cubes one or two inches on each edge, and such tests show a greater strength per square inch than would be the case if the form of the block was like that of the brick tested; so if the proper allowance for form should be made, there is little doubt but that the crushing strength of the best brick would compare favorably with the strongest granite. The best results from ordinary pressed brick usually show a strength from 6,000 to 10,000 pounds per square inch, so that the other bricks tested, considering the quality and method of manufacture, show an extraordinary strength. No test could be made for wearing qualities, but the brick exhibit, so far as can be determined by striking them with a hammer, sufficient toughness to make them a superior article of paving brick.

Cloud Rain.

Mr. John Aitken, the well known meteorological investigator, to whom we are indebted for the discovery of several fundamental facts in connection with the formation of fogs and dew, has been investigating clouds from the summit of the Rigi and Pilatus. He now finds, as in former observations, that fog is intimately dependent on the presence of dust particles in the air, each of the invisible granules forming the nucleus of a tiny head of water, these vesicles constituting in the aggregate clouds, mists, and their kindred. At elevated situations the air is comparatively free from dust, while lower down it is full of it. But while clouds are passing over a peak the number of particles varies considerably. This, he discovers by a series of carefully compiled data, is due to the fact that the air entering into the clouds has forced itself up from the valley below. Hence the mountain air is pure or impure in exact accordance with the amount of this lower world current which has reached it. When the cloud vanishes, the ether resumes its old composition. Another curious fact just discovered by the same indefatigable observer is that the moment a cloud forms it begins to discharge its contents in the shape of a steady shower of minute drops. These drops are not capable of being appreciated by the unassisted senses; but by the "fog counter," an instrument of Mr. Aitken's invention, the exact number falling on a given space can be readily noted. What is still more curious is that though the air is in such circumstances saturated with damp, seats, stones, and other large objects near the earth are perfectly dry, the drops being evaporated by the radiant heat of the ground; but a pin's head or other small object, not offering the same area, is in these circumstances often covered with a minute globule of water. The fact of a cloud thus beginning to rain small drops whenever it is formed may account for the disappearance of these vaporous masses by gradual exhaustion, without any change in the wind or temperature.

Articular Rheumatism.

In the *North American Practitioner* for September, 1891, Dr. Joseph Lane Hancock writes that for the last two years he has been treating cases of inflammatory rheumatism with a local application of carbolic acid applied in the form of a four per cent solution on a warm flannel cloth wrapped closely around the entire affected joint.

Dr. Hancock states that his custom is to leave this dressing on overnight, placing it in position just before the patient retires.

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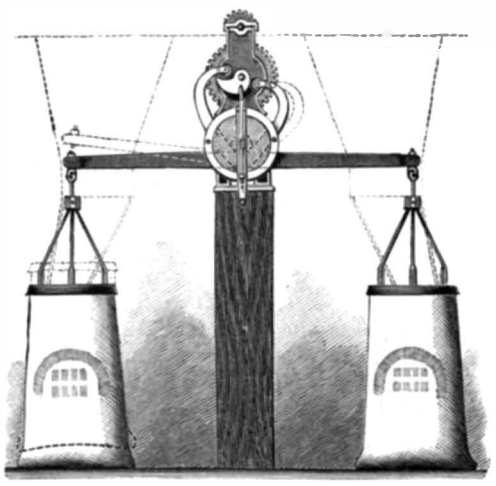
A MACHINE TO FACILITATE FILLING OF BAGS.

The filling into bags of granulated sugar, grain, etc., is designed to be efficiently and conveniently effected by the machine shown in the illustration, which has been patented by Mr. Jose R. Mesa, of St. Catalina, Correl Falso, Macuriges, Cuba. Its frame is attached to a post or other suitable support, and has a transverse pivot, on which are fulcrumed oppositely extending levers, the inner ends of which are upwardly curved, and carry at their extremities friction rollers. These rollers are adapted to be engaged by a cam on the front end of a shaft turning in bearings in the frame, and carrying a gear wheel meshing with a pinion on a main driving shaft, whereby the cam imparts a continuous swinging motion to the levers. On the free end of each lever is a bag holder, supported from an eye, and having three outwardly extending arms connected with the inside of a ring, having an outer beveled edge, around which the upper edge of the bag is held by another similarly formed ring, having grooves to accommodate the seam of the bag, the mouth edge of the bag being turned over upon the outside of the outer ring. The bag is filled by a spout, as shown in the dotted lines, or by other



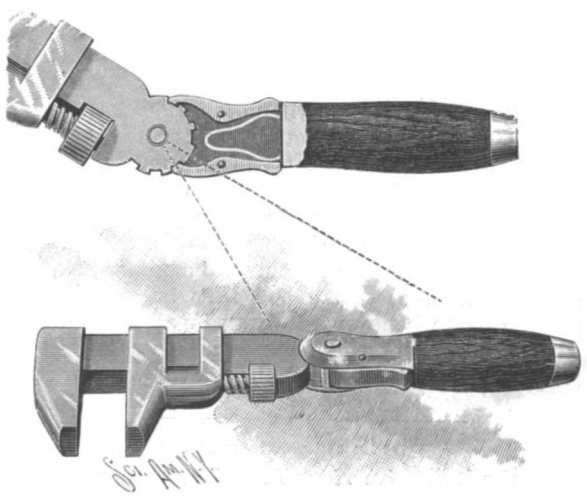
MESA'S PACKING MACHINE.

means, and, as the filling progresses, the bag is constantly swung up and dropped down upon the floor, by the action of the cam upon the levers, whereby the contents are very firmly packed. The bag is readily disconnected from the holder by a slight movement of the outer ring, just before it strikes the floor, and an empty bag is just as readily attached in position to be filled. The motion of the machine and the rate of feed are designed to be so regulated that the bag will be lifted and dropped any desired number of times before being completely filled and detached from the holder. Either of the levers may, if desired, be operated singly.

Further information, relative to this improvement, may be obtained of Mr. Henry Mesa, No. 591 Lexington Avenue, New York City.

AN IMPROVED WRENCH.

A wrench, especially adapted for use in cramped, obstructed situations, as in corners and other locations where the space is limited, is shown in the accompanying illustration, and has been patented by Messrs. William F. Parsons and Andrew Davis, of New Kamilche, Washington. The handle bar has a fixed and a sliding jaw of the usual form, and the inner end of the bar has a notched curvilinear edge, there being pivoted upon this end two parallel jaws of a grip piece, the intervening slot receiving the curved ratchet head of the handle bar. Two similar, oppositely located locking dogs are pivoted between the jaws, adapted to interlock with

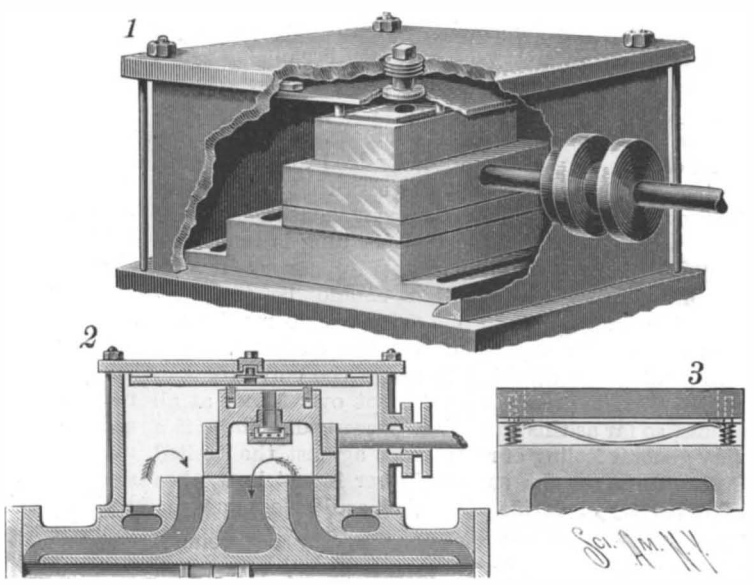


PARSONS & DAVIS' WRENCH.

the notches in the ratchet head, a spring between the limbs of the dogs causing the toes of the latter to simultaneously enter the notches of the ratchet head, and retain the grip piece at any desired point of angular adjustment. The wrench is ordinarily employed in the usual manner; but in use within contracted spaces, as in turning a bolt or nut close to a corner or near a vertical wall, the handle may be swung around, as shown in full and dotted lines in one of the figures, the grip piece being manipulated by pressing in upon the limbs of the dogs, their subsequent release causing the grip piece to be locked at the desired angle to the handle bar.

A BALANCED VALVE FOR STEAM ENGINES.

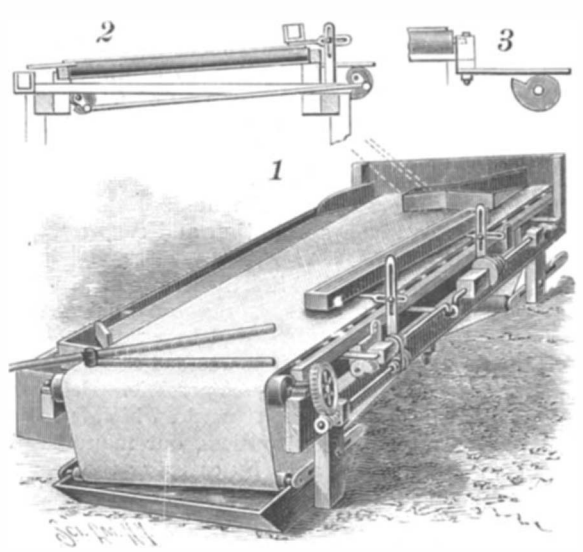
The improvement shown in the illustration is designed to render the balancing of the ordinary locomotive slide valve more perfect when the engine is moved by gravity, without steam, as when the locomotive descends a grade with steam shut off from the valve chest. Fig. 1 is a perspective and Fig. 2 a side sectional view of a steam chest in which the valve is provided with this improvement, which forms the subject of a patent issued to Mr. Daniel Kiley, of No. 12 Cooper Street, Brooklyn, N. Y. Under the lid of the steam chest is a pressure plate, held a short distance away from the lid by spacing blocks at each corner, thus affording a small steam space between the lid and plate, which is of less width and length than the inside of the steam chest. There are the usual steam ports and passages, as indicated by the arrows in Fig. 2, but in the top of the valve body are cut grooves near each side and end wall, intersecting each other at the corners to form a rectangular channel all around the top of the body, and in this channel is placed a washer plate of the same shape, there being below the plate, in each side and end channel, a semi-elliptic spring, as shown in Fig. 3, there being also at each corner a pin, around which is held a spiral spring. Upon the washer plate, in each groove, is inserted a joint bar, fitting practically steam tight, but free to slide vertically, the upper sides of the bars having a steam tight engagement with the lower side of the pressure plate, so that a shallow air tight chamber is produced between the plate and the top of the valve between the grooves, which is maintained when the valve is in motion. In connection with this chamber there is centrally formed an aperture in the top wall of the valve, in which is screwed a valve box having a disk valve that closes upwardly, but, when free to do so, drops slightly, opening a passage through lateral holes in the valve box. In the lid of the steam chest is also held a winged valve, sliding above a hole in the pressure plate by the loose engagement of its wings with a cupped recess in a cylindrical plug screwed in the lid, the hole in the pressure plate being thus sealed when the valve is held upon the plate by steam pressure. This winged valve and aperture in the pressure plate may be located at either side of the center, if desired, or anywhere within the air tight space under the pressure plate, and in the plug is located an oil cup or other means of supplying the lubricator required. When the locomotive is using steam and the wing valves close the aperture in the pressure plate, there will be only normal air pressure in the chamber under the plate, but when steam is cut off and the locomotive, in descending a grade, pumps air out of the steam chest, the wing valve is opened and the lower valve is closed by the vacuum. These valves thus allow the vacuum to get hold of the whole top surface of the main valves, the same as an ordinary valve without a balance, and lessen the friction between the joint bars and pressure plate.



KILEY'S BALANCED VALVE.

AN IMPROVED ORE WASHING JIGGER.

The illustration represents an ore washing machine designed to be simple and durable in construction, and very effective in operation, completely separating the ore from the tailings. It has been patented by Mr. Thomas Rowe, of the East Fork Concentrator, Triumph P. O., Alturas County, Idaho. Upon a suitable frame are blocks, on which rests the jigging frame, supporting transverse rollers over which passes the endless carrier belt, also passing over rollers journaled at the ends of the main frame, one of the latter rollers receiving motion to move the belt. The jigging frame is slightly inclined longitudinally, and is also inclined transversely, the belt being correspondingly inclined in the two directions. After the belt leaves the roller at the high end of the table, toward which its top portion always travels, it passes under a roller in a depositing trough beneath, filled with water or other suitable liquid, and adapted to receive the precious metals separated from the tailings. The belt passes from this trough upward, over an intermediate roller, and thence around an adjustably journaled roller, whereby its tension may be conveniently regulated, before passing over the roller at the other end of the table. On the sides of the jigging frame are transverse strips resting on the tops of cams, as shown in section in Fig. 3, these cams being secured on longitudinal shafts, one of which has a cone pulley connected by belt with a power shaft, while each of the shafts, one on each side of the machine, has a crank arm, and the crank arms are connected with each other by a link, as shown in Fig. 2, whereby, as the machine is operated, the cams are continuously lifting and suddenly dropping the jigging frame, thereby imparting to it a jigging motion. A belt from the longitudinal shaft rotates a short shaft, on which is a worm in mesh with a worm wheel on one end of the shaft carrying the roller over which the carrier belt passes at the high end of the table, giving a traveling motion to the belt as the jigging frame is operated. At the high side of the frame, but near its lower end, directly over the belt, is the inlet chute, through which the ore is passed on to the belt, a trough to supply water being also adjustably supported at the desired distance above the high side of the belt by means of transversely extending slotted arms connected with vertical slotted posts. One or more perforated water supply pipes also extend over the belt near its high end, for the further washing of the pulp and clearing of the ore. At the low side of the frame is an inclined board discharging the tailings into a longitudinal trough, having a partition near its high end forming a second compartment, the latter discharging into a receptacle, into which some of the heavier tailings are washed, to be treated over again, while at the lower end of the frame is a transverse board to prevent the material flowing off that end of the belt. As the pulp is fed on to the carrier belt against the pitch of the latter, the jigging motion and the flow of water cause the heavier particles to be



ROWE'S ORE WASHING JIGGER.

gradually separated from the tailings as the belt advances, the tailings passing into the trough on the low side. The ore, however, settling upon and adhering to the belt, is carried forward in almost a straight line, adhering to the belt when the latter passes over the roller at the high end, to be washed off and deposited in the settling tank.

The Language of Monkeys.

Professor Garner, who has acquired reputation as a student of the monkey language, proposes to visit Africa, with such appliances for a residence among the gorillas as will enable him to become acquainted with their speech, the vocabulary of which is likely to be richer than that of ordinary monkeys. He intends to occupy a large and strong iron cage, in which he can be safe from the attacks of the powerful animals, while he listens to their remarks and preserves them by the phonograph. Professor Garner thinks that he will be able to ascertain the views of leading gorillas with less difficulty and more precision than is possible in the case of some distinguished persons who speak with great facility on topics of vital interest.

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THE "TEMPLE BLOCK," SALT LAKE CITY.

The Mormon Tabernacle at Salt Lake City, the central one of the three structures shown in our illustration, has had the reputation of being, ever since its erection, the largest assembly hall in America. It is capable of comfortably seating 8,000 people. It is 250 feet long, 150 feet wide, and 80 feet high. The building was completed October 6, 1867, having been a little more than two years and a half in process of erection. Its construction was superintended by Mr. Henry Grow, and the cost was paid by the voluntary contributions of the Mormon people. The roof is composed of a lattice truss, the thickness from the inside of the ceiling to the shingles being ten feet, and the trusses resting upon forty-four sandstone piers built in the most substantial manner. There are twenty double doors, nine feet wide, opening outward, with large windows above them running up under the eaves, serving the double purpose of lighting and ventilation, there being also two large windows in the roof. It is lighted by electricity. The large organ with which it is furnished was made in Salt Lake City, and nearly all of the work was done within the Tabernacle itself. Mr. Joseph Ridges superintended the construction and Messrs. Johnson & Taylor added many improvements. It has 57 stops and 2,648 pipes, the largest made of wood brought from Southern Utah, and its cost was over $100,000.

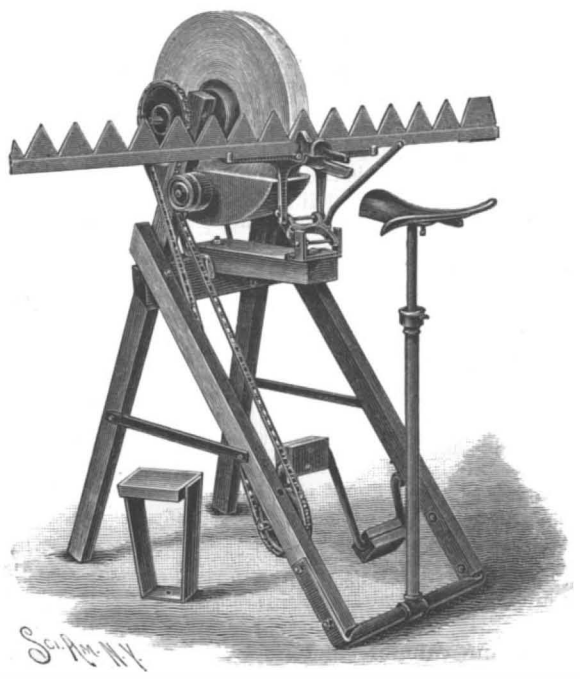
Twice a year, April 6 and October 6, the Tabernacle is filled to its utmost capacity. Perhaps the most remarkable thing about the building is its marvelous perfection as a sound chamber, a faint whisper being plainly heard 250 feet away, at which distance also can be distinctly heard the fall of a pin dropped only two inches upon a table. The latter fact was demonstrated only a few weeks since, in the presence of a representative of the SCIENTIFIC AMERICAN. Curiously enough, however, it appears that, although a speaker need never speak very loudly to be distinctly heard in all parts of the building, yet a serious obstacle to the hearing frequently arises from any noise made by the hearers—the moving of feet, or other slight cause, naturally producing as far-reaching effects as the voice.

The Temple, shown at the right of the picture in its present unfinished state, was commenced in 1853. Upon the arrival of the Mormons in Salt Lake Valley, in 1847, Brigham Young, looking toward Ensign Peak, marked the site with his cane, saying: "This is the place to stay; this is the spot I have seen in vision." When completed it will be one of the most durable and imposing edifices in America. The walls are ten feet thick at the surface of the ground. There are to be three towers at each end, the center ones being each 220 feet high. The building is 186 feet long by 99 feet wide. It is built of white granite, quarried at the mouth of the Little Cottonwood canon, twenty miles distant, and formerly hauled by ox teams, but now brought by rail direct to the Temple grounds. It has cost up to date nearly four millions of dollars. The Mormon temples are not designed for public worship, but for the administration of ordinances, rites and ceremonies, etc., and the assemblies of the orders of the priesthood.

The Assembly Hall, in the southeast corner of "Temple Block," is 68 by 120 feet in size, and has an auditorium designed to seat 2,000 persons. The cost of the building was nearly $250,000.

A MACHINE TO GRIND SICKLE BLADES, ETC.

A compact and simple machine to facilitate the grinding of sickle blades of harvesters or mowing machines while on the cutter bar, giving them a correct beveled cutting edge, and also adapted for sharpening



KNOBEL'S SICKLE GRINDER.

cutting tools of various kinds, is shown in the accompanying illustration. The improvement forms the subject of a patent issued to the Rev. A. Knobel, of Louisville, Ky. To a forwardly extending portion attached to a casting to which the four legs are bolted, is attached a sickle clamp, consisting of three pieces, one of which is bolted to the base piece, an intermediate part being attached to this piece by a hinge joint, and an upright clamping section being hinged to the intermediate part, whereby the knife may be kept in a horizontal position and at the same time moved perpendicularly to bring all parts of the edge to be ground against the stone. A lever inserted in holes in either side of the intermediate piece may be used to move the knife perpendicularly, but this lever may be dispensed with, and the knife moved by simply grasping a two-part handle, the lower part being movable, so that by closing the hand the knife is gripped. The clamping section has side arms or extensions, whereby the knife will be firmly seated when the end sections are being operated on, and the clamp, while holding the knife securely, allows it to be quickly and easily released and a new section clamped as the work progresses. The seat for the operator has a pipe support, in the upper end of which slides a piece of square iron, to which the saddle is attached by a set screw, so that it may be adjusted backward and forward, while the seat-holding rod is held in any position to which it may be raised by a key seated in the socket portion of the support. The tool rest or table is designed to facilitate the handling of the work, and the cranks and pedals are adapted to insure a steady motion in either direction.

The Manufacture of Mosaics.

One of the few industries of Rome is the manufacture of mosaics, the largest establishment being under the control of the Church, and employed almost entirely in the adornment of churches and religious establishments. The process of making a picture in mosaic is very slow and requires the highest order of skill. To begin with, mosaic is made of glass, and its value consists in its being indestructible.

The workmen in great pictures have to use something over 26,000 shades of colored glass to produce the tints requisite, as in a mosaic every color is necessary, just as in an oil painting. To make a picture, the process is this: A plate of metal of the required size is surrounded by a raised margin an inch in height. A mastic cement of powdered stone, lime and linseed oil is spread over the bottom of the plate, and that is covered up with plaster of Paris to the level of the rim. Upon this the picture to be made is very carefully drawn, and the mechanic's work begins.

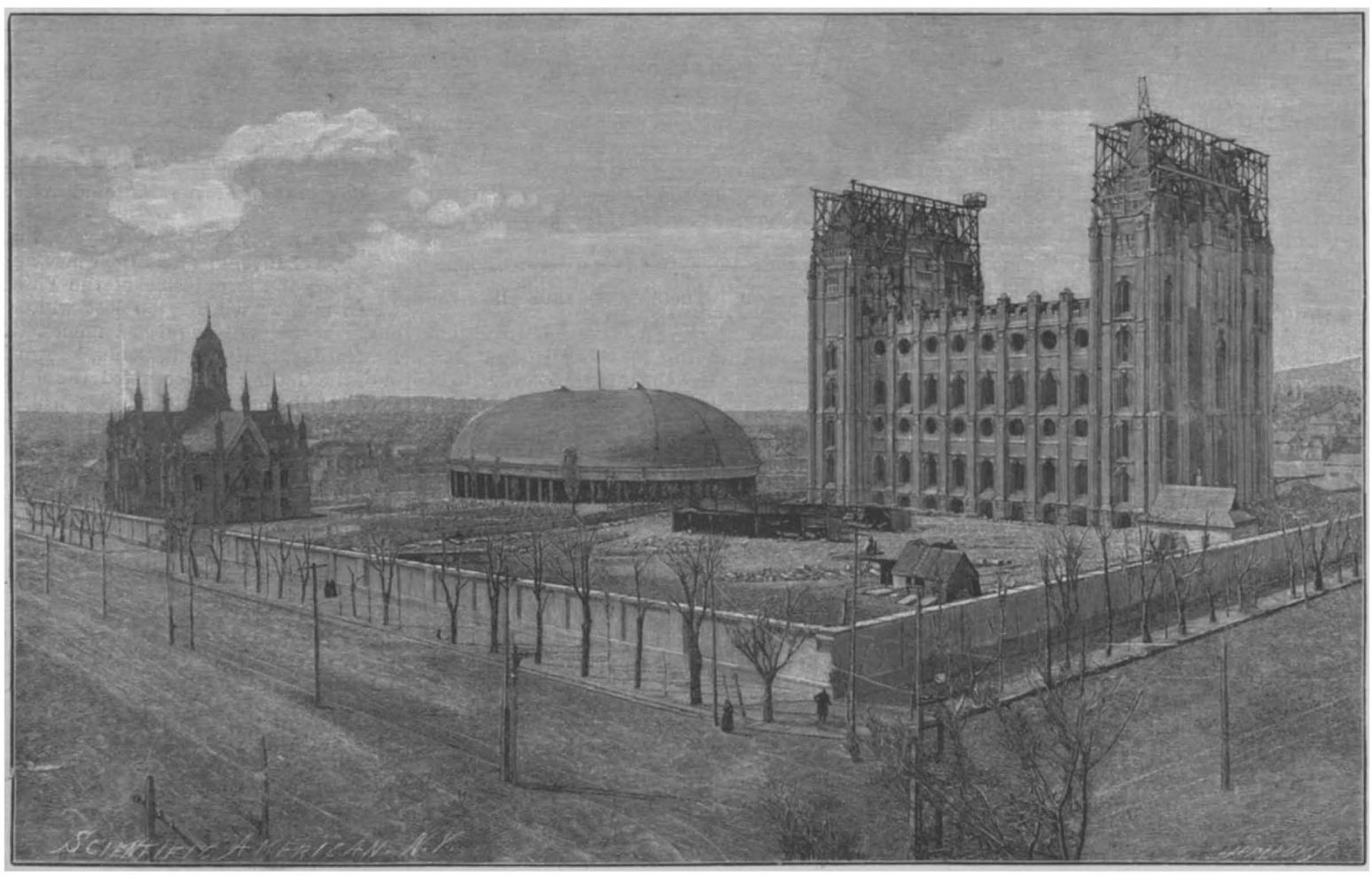
He takes a piece of glass of the exact tint necessary and fits it into its place, grinding to the shape. Then he goes on, one piece at a time, till the picture is finished; then the face is ground down to smoothness, and the picture is set in its place.

Some of the greatest pictures of ancient and modern times are in mosaic, the tints, with all the delicate shades, being carefully reproduced as in oil, and the effect being finer. The ceilings of many of the great churches of Rome are entirely of mosaic, as well as many of the altar pieces and other decorations. As they are entirely indestructible, and never lose their color, they are very much prized. A picture in mosaic costs a great deal, but then it is eternal, barring fire and earthquakes.

All over Rome there are small shops devoted to the manufacture of mosaic table tops, box covers, etc., the workman toiling all his life on one subject. The man who begins on St. Peter's or the Coliseum never does any other subject, and he becomes so skillful in this one that he is enabled to execute it not only well, but cheaply. He has only the tints to manage that enter into one picture, and he places them mechanically and very rapidly.

Cement for Metal.

This well known cement, which is prepared from zinc oxide and zinc chloride and some other material, such as iron slag, powdered glass, etc., may be caused to set more slowly by adding with the zinc chloride, when it is mixed with the other ingredients, some zinc sulphate and powdered limestone. The adhesive power of the cement (for cementing metals) may be increased by the addition of 2 per cent of ferrous sulphate.—*H. Spenle.*



THE FIVE MILLION DOLLAR MORMON TEMPLE AT SALT LAKE CITY.

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Starboard and Port.

Since the 1st of July, of this year, the old words of command for altering the helm, viz., "starboard" or "port," have been given up on board the ships of the North German Lloyds and the Hamburg-American lines, and the order "right" or "left" substituted.

It is difficult to break with old customs, and seamen in especial are conservative; it is, therefore, not a matter of wonder that many old sailors look with great disfavor upon this latest innovation. On board the steamers of the two great lines mentioned above, however, the change has been made obligatory, and, according to a report forwarded to the directors by one of their oldest captains, who was himself opposed to the idea, has been attended with the happiest results.

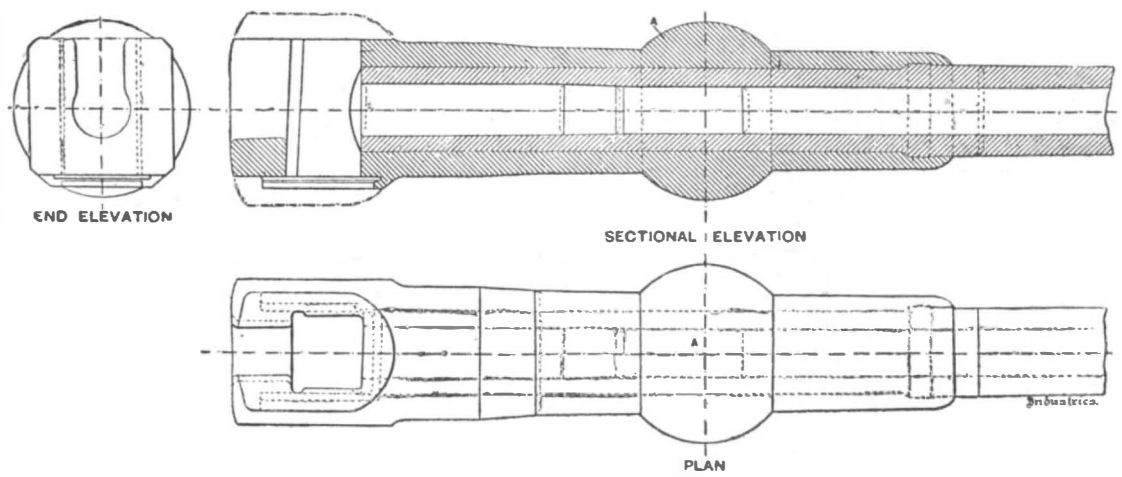
As soon as the order "right" is given, the telegraph is moved to the right, the wheel is revolved to the right, the ship turns to the right, the rudder indicator points right, the rudder itself moves right, and the steering mark on the compass as well; and so *vice versa* when the order "left" is given. Nothing can be simpler, and no possibility of mistake can arise.

The objection has been raised that the new words of command are not international, and are therefore illegal. This statement, however, will not hold good, as both English and American pilots, in whom every one has confidence, have made no difficulties in using the new words of command when piloting ships of the two before mentioned companies.—*Nautical Magazine.*

THE "ADAMSON" GUN.

The illustrations represent a sectional elevation, end view, and plan respectively of a gun invented by the late Mr. Daniel Adamson. The principal feature of this type of gun consists in abolishing the trunnions and substituting therefor a ball joint, A, or spherical enlargement, which works in a suitable socket on the gun carriage. The advantage claimed for this arrangement is that the gun—a model of which is now exhibited—can be readily trained to cover a much greater range without moving the carriage. The gun was made at Bofors, in Sweden, and, according to *Industries*, has been tested by Swedish artillerists with the following results:

The gun was fired five times in twenty seconds. An elevation of 25 degrees was found to carry the projectile 26,250 feet, or nearly five miles. Eighty-five rounds were fired. It is stated that the gun, with even more than sufficient strength, combines great durability with respect to its weight, and that the mechanism is simple and easy to manage, and does not require experts for its handling. The leading particulars of this gun are: Caliber, 3·36 inches, length, 98·43 inches; weight, 1,200 pounds; rifling, number of grooves, 24; depth of grooves, 0·039 inch; width, 0·295 inch; width of lands, 0·138 inch; twist muzzle, 33 caliber; weight of shell, 14·77 pounds; weight of charge (black powder), 5·51 pounds; volume of chamber in case, 161·72 cubic inches; volume of bore, 796·40; muzzle velocity, 1,020 feet with black powder, and 1,970 feet with smokeless powder.



THE "ADAMSON" GUN.

The Tocci Twins.

The *Southern Practitioner*, an influential monthly devoted to medicine and surgery, published at Nashville, Tenn., has produced in the January number the engraving of the Tocci twins, with the description, which appeared in this paper in issue of December 12, last year. In referring to this interesting specimen of tocology, the editor states the source from which his article is derived as follows:

"The description is taken from that standard and most reliable publication, which we regard as the best journal in America or the world, the SCIENTIFIC AMERICAN. Having had a personal and private interview with Mlle. Christine Millie in 1860; having seen and had a personal interview with Messrs. Chang and Eng, the great Siamese twins; and in a somewhat arduous work in medicine since 1854, it has been my opportunity to see more or less of monstrosities and abnormal formations, yet I do not hesitate to class the Tocci twins as something more than remarkable. It is to be hoped that if they ever marry they will have 'two souls with but a single thought, two hearts that beat as one.'"

Anti-Friction Bearings.

The metal of the well known patent Magnolia anti-friction bearings has been found by analysis to have the following composition:

Lead	80 lb.
Antimony	15 "
Tin	5 "
Bismuth	4 oz.
Graphite	8 "
Aluminum	4 "

Letters Patent for Inventions.

The origin of letters patent for inventions dates as far back as the Statute of Monopolies in the reign of James I., by which statute exclusive rights were given to the first and true inventor of a new manufacture for a term of fourteen years, provided it was not contrary to law or mischievous to the State. A patent for a useful invention is not under our law, nor, indeed, under the law of England nor any foreign country at the present day, the grant of a monopoly in the sense of the old common law. It is the grant by the government to the originator, discoverer, or inventor of a new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereon, of the exclusive right, for a term of years, of practicing that invention. The consideration for which this grant is made by the Crown is the benefit to society resulting from the invention, which benefit is conferred upon the public by the inventor: first, by the immediate practice of the inventor under the patent; and, secondly, by the practice of the invention or the opportunity to practice it, which becomes public property on the expiration of the patent.

The history of patents in Canada begins in 1824, when the first patent was issued on the 8th of June to one Noah Cushing, of the city of Quebec, for a washing and fulling machine. From that date up to the year of the confederation of the Provinces, there were only 1,866 patents issued, and these comprised the patents issued by each of the provinces or colonies, which before that period had a separate patent act of its own.

Since confederation, however, a great increase has been made in the number of patents taken out in Canada, nearly 40,000 patents having been issued since then. Our valuable manufacturing, lumbering, and mining industries, fostered and protected by the national policy, have in a large measure stimulated the progress of invention in this country, and it may safely be said that the sons of this fair dominion have produced inventions the importance of which is in no degree inferior to those of our neighbors south of us. Such is the enterprise of Canadians that patents for important inventions are now being taken out by them not only in Canada, the United States, and England, but in the various colonies of the empire, and in many foreign countries.

Patents are granted in Canada for a term of fifteen years. The first government fee is $20, which fee protects the invention for five years, two further fees of $20 for each succeeding five years being requisite in order to protect the invention for the full term. It is, therefore, necessary to pay the first fee in order to obtain the patent, and the subsequent fees in order to keep it alive the full term. Two other requisites are necessary in order to keep the patent alive, namely, the article covered by the invention must be manufactured within two years from grant, and it must not be imported for more than a year. Specifications, drawings, and models are required to be sent to the Canadian Patent Office before a patent will be granted, and such is the importance of having inventions thoroughly covered, in order to protect the inventor from infringement, that special experts are employed by inventors, so that their applications may be prosecuted to a successful issue before the Patent Office. It is essential that men having a legal as well as a mechanical experience should be employed.

Many people are in the habit of not only thinking of, but speaking of, inventors as cranks. But when one considers the advantages reaped from the indomitable energy and perseverance of such so-called cranks, it must be confessed that to that class of the community we are more indebted than to any other.

Lord Bacon corroborates this statement in the following:

"The introduction of great inventions appears one of the most distinguished of human actions, and the ancients so considered it; for they assigned divine honors to the authors of inventions, but only heroic honors to those who displayed civil merit, such as the founders of cities and empires, legislators, the deliverers of their country from lasting misfortunes, the quellers of tyrants, and the like. And if any one rightly compare them, he will find the judgment of antiquity to be correct; for the benefits derived from inventions may extend to mankind in general, but civil benefits to particular lands alone. The latter, moreover, last but for a time, the former forever. Civil reformation is seldom carried on without violence and confusion, while inventions are a blessing and a benefit without injuring or afflicting any."—*The Canadian Manufacturer.*

The Carbonization of Wool.

The successful extracting of cotton from union cloths without injury to the reclaimed wool has led to the extension of the process to raw wool for the purpose of ridding it of burrs and other particles of vegetable matter. These burrs are very difficult to remove, and often leave a large amount of waste during the process of extraction, while, if allowed to remain, they would do incalculable mischief to the yarn. There are two methods of dealing with them in general use—one is to pass the wool through a burring machine, which beats the burrs from the wool; and the other is to destroy the burrs by carbonization. The former method is most suitable when the wool contains large burrs; but carbonization is more economical for wool containing small burrs, straw, chaff, and other small particles of matter. One drawback in using the burring machine is that many of the smaller burrs adhere to the wool after being passed through the machine, and carbonization is afterward resorted to, in order to reclaim the wool attached to them. For this and other reasons the chemical process is likely to totally supplant the burring machine in course of time. The process generally adopted is similar to the one followed in making extract wool. The burry wool is first saturated with a dilute solution of sulphuric acid, whizzed in a hydro-extractor, and afterward opened out and spread in a heated room. Here chemical action is quietly at work, the burrs are deprived of their hydrogen, and crumble to carbon, while the wool is liberated and washed.

Another method which finds favor is to saturate the wool with a solution of chloride of aluminum ($Al_2 Cl_6$). After being whizzed and dried, it is taken to a room heated to about 200° F., where it remains for a little less than an hour. Washing in fuller's earth and water follows, by which the chloride is removed and the residue of carbonized matter washed away. The prejudice which formerly existed against these methods of extracting burrs is rapidly disappearing, as experience has proved that if the wool be properly clean previous to carbonization, and the acid the required strength, no injury to the fiber is caused, neither is the felting of the wool in any way destroyed.

Convention of the National Association of Inventors.

On January 19 of the present year, the National Association of Inventors held their first annual meeting. This body is the outcome of the Patent Centennial which met at Washington last winter. The list of officers includes distinguished names. The President, Dr. Gatling, of Hartford, Conn., known as the inventor of the Gatling gun, occupied the chair, and was the writer of the presidential address, which was read by the Commissioner of Patents, Hon. George E. Simonds. Other officers of the association are as follows: Vice-Presidents, Hon. Gardner D. Hubbard, president of the American Geographical Society; Wm. A. Anthony, president of the American Institution of Electrical Engineers; Thomas Shaw, of Philadelphia, inventor; and Hon. Benjamin Butterworth, secretary of the World's Fair; Secretary, Prof. J. E. Watkins; Treasurer, Mr. Martin E. Stone.

The president's address touched upon the propriety of liberal treatment of inventors, the necessity for increasing the number of Patent Office examiners, and the necessity of a special patent court. The World's Fair and the exhibition of the results of American invention were also spoken of. Informal discussions of the work of the two main committees on legislation and manufactures occupied much of the time of the meeting, and finally an adjournment was taken for one year, to meet again in Washington.

A WELL known business man, referring to the success of his firm, said: "We attend to our own business and nothing else. You never hear of any of us being on the road nor out driving. We do not go to the theater. We have no outside business—no ventures or speculations in oils, wild lands, patents or stocks. What money we have we have put into our house. We take care of our business and our business takes care of us. We keep abreast of the time."

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THE NEW AMERICAN WAR STEAMER MIANTONOMOH.

The double turreted monitor Miantonomoh represents the latest accession to the United States navy. She is now practically completed, and nothing is left for her full equipment and preparation for war but the introduction of some minor pieces of machinery, and some additional supplies, her crew and much of her ammunition being now on board. She is a typical battle ship. It is believed that there is no ship of war afloat in any water that she could not cope with. In the matter of speed, she is, like all the monitors, somewhat deficient, her rated speed being 10½ knots per hour.

The keel of the Miantonomoh was laid by John Roach & Sons, at their works on the Delaware River, in 1874, and the hull was completed there. In many respects she represents a reproduction of the old wooden monitor Miantonomoh. The present ship is built of iron, except as regards her armor plates, which are of steel. The general dimensions, as given in the official records of the navy, are as follows:

Length, 250 feet; beam, 55½ feet; mean draft, 14 feet 1¾ inches; displacement, 3,815 tons; indicated horse power, 1,030. The maximum depth is 17 feet 4½ inches, leaving about 3 feet of freeboard. The engines are of the inclined compound type, and actuate twin screws. The armor of the hull consists of a protective belt 6 feet deep; the upper section is 7 inches thick, and goes 18 inches below the water line. The next section is composed of two superimposed plates, one 3 inches and one 2 inches, and the final strip at the bottom of all is 3 inches thick. The deck, which is almost flat, and non-deflective, is composed of two superimposed plates of ⅞ inch steel planked over with 4 inch pine.

The outer plating of the turrets is 11½ inches thick. This is backed with 10 inches of wood, which is again backed with two steel plates, each ½ inch thick. The turrets are 24 feet in external diameter, rise a little over 6 feet above the deck, and are each surmounted by a conning tower a little less than 8 feet diameter at the base, and projecting 2 feet above the top of the main turrets. In action, when the turret is struck, rivet heads or splinters are liable to be detached and to fly off with considerable velocity. To protect the firing crew from injury, an inner shield lines the turret. This shield is spaced off 8 inches from the backing, and is composed itself of ¾ inch steel plate. The deflective armor of the conning tower is 9 inches thick.

In each turret two 10 inch breech loading rifles are mounted in parallel, and are manipulated by hydraulic gear. Each gun is held in place by hoops upon a saddle, which is free to slide back and forth upon the rails of the carriage. As shown in the cut, the carriage is pivoted to the turret at its front end, so as to be incapable of recoil. The recoil backward of the gun itself is checked by a hydraulic cylinder containing water, through which a piston is driven by the action of the gun on its recoil. A very limited waterway is provided for the escape of the water from behind the piston, so as to bring the gun to a stop without serious shock. With a full charge, the gun recoils about forty inches.

Below the gun deck of the turret the space is utilized for the supply of ammunition. The shells and powder cartridges are brought in, and, by means of a circular railroad, are wheeled around the turret so as to come under the hatch, which, of course, shifts around as the turret turns. An elevator is provided for carrying them up to the gun deck, and there they are shipped on a carriage upon another transverse railroad, which brings them opposite the open breech of the piece. For loading, the breech is dropped, bringing the bore in line with an inclined hydraulic cylinder and rammer in its rear. An approximately vertical hydraulic cylinder and piston permit the breech to drop or raise it, as desired. The shell is pushed home by a hydraulic rammer; next the powder is inserted, bag by bag, and pushed home by the same rammer. Brown perforated hexagonal prismatic powder (Dupont's) is used. It is packed tightly in the cartridge bags, several of which are used for a charge. In the rear of each bag are nine hexagonal grains of priming powder to disseminate the ignition. The breech block, which is of the interrupted screw type, with mushroom and gas check, is inserted and turned home, a copper priming needle is pushed through the axial vent of the breech block, so as to pick a hole in the rear powder cartridge, the primer, which may be frictional, detonating, or electric, is put in place, and the gun is ready for firing. The direction of fire is fixed by rotating the turret. In the conning tower, the firing officer looks out of a little cross-shaped window, which in itself forms the rear sight; forward on the roof of the turret is the front sight. These two are arranged accurately parallel with the vertical planes passing through the axes of the guns. The elevation of the guns is determined by the hydraulic ram just mentioned, and actuated by a lever in the conning tower, and the firing officer has at his side a dial indicating the number of degrees of elevation given each piece.

Through the center of the turret a hollow spindle runs down the bottom of the ship, through which communication is had from the conning tower to the different mechanism required to be worked therefrom. Without leaving his place, the firing officer can locate the turret to bring his sight to bear upon the object, can raise or depress either or both of the guns to get the range, and can fire them singly or simultaneously, if desired, by the electric primers, simply pressing a bulb to produce the ignition. Immediately after firing, the turret can be rotated so as to present its unperforated side to the enemy, while the guns are being loaded. Levers and valve handles are provided for all the manipulation, within easy reach in the conning tower. By the speaking tubes and bell calls of the central spindle, the officers in the tower can communicate with all parts of the ship, including the other turret.

The water supply for the hydraulic machinery of the turret enters through this center spindle, which, it will be understood, is stationary, the turret rotating around it. Two collars, three sided, or D shaped, in section, encircle its lower part, and, as these collars rotate with the turret, the water is delivered into one and discharged from the other, through the center spindle. The problem to be solved was the introduction of water into machinery in and moving with a rotating turret, through whose center a stationary hollow spindle extends.

The ship is provided with a fighting mast of hollow steel, through whose center ammunition is hoisted to the fighting top. Her armament includes the four 10 inch breech-loading rifles, whose manipulation has been described, and which weigh about 63,000 pounds apiece. One is 27 feet, another 29 feet, and two are 30 feet long. They have a practical range of 7 miles. The service charge is 256 pounds of powder. The projectile is a cast iron shell with soft metal rotating band, weighs 500 pounds, and contains about 12 pounds of shell-exploding powder, contained in 128 cotton bags. Each shell has a percussion primer. The guns are American in their assembling, having been turned out at the Washington navy yard. The shell is $9\frac{95}{100}$ inches diameter, giving only $\frac{1}{20}$ inch total windage. The rotating band, however, fits so tightly as to leave little chance of escape of gas.

A very important feature is the steering mechanism. The ship steers very badly by hand, but is provided with steam steering engines that keep her under perfect control. An electric steering device is to be put in that will enable her to be worked from either conning tower. Thus the ship will be fought entirely from this point, the steering, rotation of the turret, ranging and firing of the guns, being effected therefrom, and within absolute control of a single man if desired.

To prevent water from entering around the turret a diaphragm of leather is provided which encircles the base of the turret and is held down by segmental plates of metal and expansion turnbuckles against a wooden scupper groove. In action the turnbuckles are to be backed up a little to relieve the friction, so that the turret can be turned freely and without injury to the diaphragm.

A double line of teeth encircle the base of the turret, with which the turning engine engages. The turret is carried by 20 forged steel coned rollers, 14 inches diameter and 10 inches thick. Eight small horizontal rollers bear against the interior of the base, to prevent lateral displacement.

The vessel has a double bottom, a clear space of 28 inches existing between the two skins. She is lighted throughout by electricity.

The Coloration of Preserved Foods.*

The time-honored method of imparting a beautiful green color to preserved foods consists in treating the articles to be colored with a solution of copper sulphate, which is quickly poured off and the last traces removed by repeatedly washing with water; the preserved articles are then boiled and the vessels containing them are soldered up. The coloration results from the formation of the copper salt of an acid derived from phyllocyanin. This body is very inert, is insoluble in water, hydrochloric acid and acetic acid, soluble in alcohol, and indifferent to the action of light. As the quantity is quite small, only a few milligrammes in 100 grammes, the author is disposed to tolerate the practice.

The green coloring matter of leaves, etc., is extremely sensitive both to light and to acids of every kind. In order to hinder its decolorization, sodium carbonate is commonly added to green vegetables before cooking, by which treatment free acids are neutralized, and also such salts as potassium acid oxalate. Not only is the action of the acids upon the chlorophyl thus prevented, but a relatively stable sodium salt, green in color, is formed, enhancing the effect. A. TSCHIRCH.

AN alloy which adheres firmly to glass and can, therefore, be used for joining up glass tubing, is said, by Mr. F. Walter, to be made by adding 5 per cent of copper to 95 per cent of tin. The tin is first melted and the copper added subsequently.

* Read at the sixty-fourth meeting of the Deutsch. Naturforsch. u. Aerzte. Through *Chem. Zeit.*

Correspondence.

The 100 Puzzle.

To the Editor of the Scientific American:

The request of I. W. B. (Dec. 19, 1891) for a solution of the "100" puzzle has, I note, brought out a number of ingenious *evasions* of the terms of the puzzle. The only way in which a study of such problems can be made of use is in trying to discover *why* they are insoluble.

Referring to the table below, the reader can see that the sum of nine consecutive numbers, beginning at 1 (column 1), is equal to 5 nines, 45, and that the transference of any figure to the place of tens (columns 2 and 3) subtracts the amount of the figure from the units and adds it to the tens, thus increasing the total by as many nines as there are units in the figure. The sum of any nine consecutive figures can never be therefore anything but a multiple of nines. The sum of any nine consecutive numbers (columns 4 and 5) will also be as many nines as the lowest figure of the series contains more than one, plus the original 5 nines of the lowest series, and the sum of any two series will differ by as many nines as the difference in their lowest figures.

9	9	9	14	19	—9—
8	8	8	13	18	—8—
7	7	7	12	17	—7—
6	6	6	11	16	—6—
5	5	5	10	15	—5—
4	4	4	9	14	—4—
3	3	3	8	13	—3—
2	2	20	7	12	—2—
1	10	1	6	11	—1—
45	54	63	90	135	45
5 nines.	6 nines.	7 nines.	5 nines + 5 nines.	5 nines + 10 nines.	

Another peculiarity of the nine digits is that shown in column 6, where each of the 5 nines is successively canceled till there is no remainder.

I saw it demonstrated some years ago that all the curious properties of the figure 9 would pertain to the figure 8 if our notation was reckoned by nines instead of by tens. A. C. B.

Frankford Arsenal, Pa.

How to Improve the Acoustics of Halls and Churches.

To the Editor of the Scientific American:

I have read with much interest what Dr. Ephraim Cutter has suggested about getting the key note of an auditorium, all of which is reasonable, but now I will suggest a remedy for a very little trouble with churches and halls where it is most difficult to hear the voice of the speaker distinctly for more than 25 feet distant.

The reason is that the sound is absorbed by the walls and furniture on the same principle that dark surfaces absorb light and heat.

In my long experience in constructing cold storage and refrigerating rooms, I have found, when the rooms were perfectly covered with a jacket of thick cotton rattan, without a single board or piece of wood in sight, that ordinary talking could be easily heard a hundred feet distant.

We now use an artificial board about one inch thick. It is very porous and lighter than cork, and is entirely free from vibration, and thus a perfect non-conductor of sound as well as of heat. If a hall should be finished with this insulating board instead of plaster and wood finish, there would be no trouble for any speaker to be heard in the most remote corners. A. J. CHASE.

Boston, Jan. 26, 1892.

Street Railroads.

It is but a little time, says the *Railway Age*, since all street railways were horse railways, and it is surprising to learn that already more miles of lines are operated by electricity and steam power than by animals, and still more surprising that electricity is even now used for more than half as much mileage as that operated by animal power, as the following statistics of the United States show:

Number of miles operated by animal power	5,443
Number of miles operated by electricity	3,099
Number of miles operated by steam motors	1,918
Number of miles operated by cable	660

The number of horses employed on street railway lines in this country is stated to have decreased 28,681, being now only 88,114, while electricity is still pushing forward at a rapid rate to displace the four-footed motors.

Electric Lighting at the World's Exposition.

The Fine Arts Building is to have no fewer than 12,000 incandescent lights. The grand Manufacturers' Hall is to have 2,000 arc lights of 2,000 c. p. each. The total reached so far for all the buildings is 5,189 arc lights and 14,700 incandescents, with some 10,000 more incandescents for the Administration Building. Allowing 20 cents per night per arc, that means over $1,000 nightly for arc lighting; and should all the 25,000 incandescents burn every evening there will be a further item of another $1,000, assuming a rate of one cent per lamp per hour for four hours. The lighting effects will certainly be the finest the world has ever seen.

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THE WASHINGTON GUN FACTORY.

In 1866, the Washington navy yard was fixed upon as the site of a naval gun factory, for the finishing of guns from forgings furnished by outside American steel manufactories, a similar gun factory for the army being established at West Troy, N. Y. At that time there were not in the country any steel manufacturers having the plant necessary to make these great forgings, but, under the encouragement guaranteed by the government, private enterprise was stimulated, and within the following two years both the army and navy departments were able to make satisfactory contracts with American producers, for the heaviest forgings, of a quality which would stand the severest tests. It is conceded that the plant now established at Bethlehem, Pa., is equal if not superior to any in the world for the production of armor and high-powered gun forgings.

The Washington gun factory was promptly proceeded with, and has already turned out a large number of six inch rifled guns, with a smaller number of eight and ten inches caliber, and the work for nearly a year past has also embraced those of twelve inches caliber. Work is also proceeding upon lathes for the production of 13, 14, and 16 inch guns. Our view gives a good idea of the appearance of the lathe room, to which the forgings are first sent, after the most careful inspection, rigid tests being made of several pieces cut from each forging. The lathes are served by a 110 ton overhead traveling crane, composed of a bridge which travels lengthwise the shop, a trolley traversing the bridge and fitted with gearing that hoists and lowers the weight to be moved. The power is transmitted through square shafting, the motions being controlled by clutches. On their arrival, the cars containing the forgings are run under the overhead cranes, the forgings being thus taken directly to their respective lathes for boring and turning, two operations which are frequently performed at the same time, the cutting tools shaving off the outside of the tube while the "hog bit" is taking the first and second boring cuts. The final boring cut is taken with a packed bit, this work and that of rifling being intrusted to very skillful mechanics only, as any error here would cause the ruin of the piece.

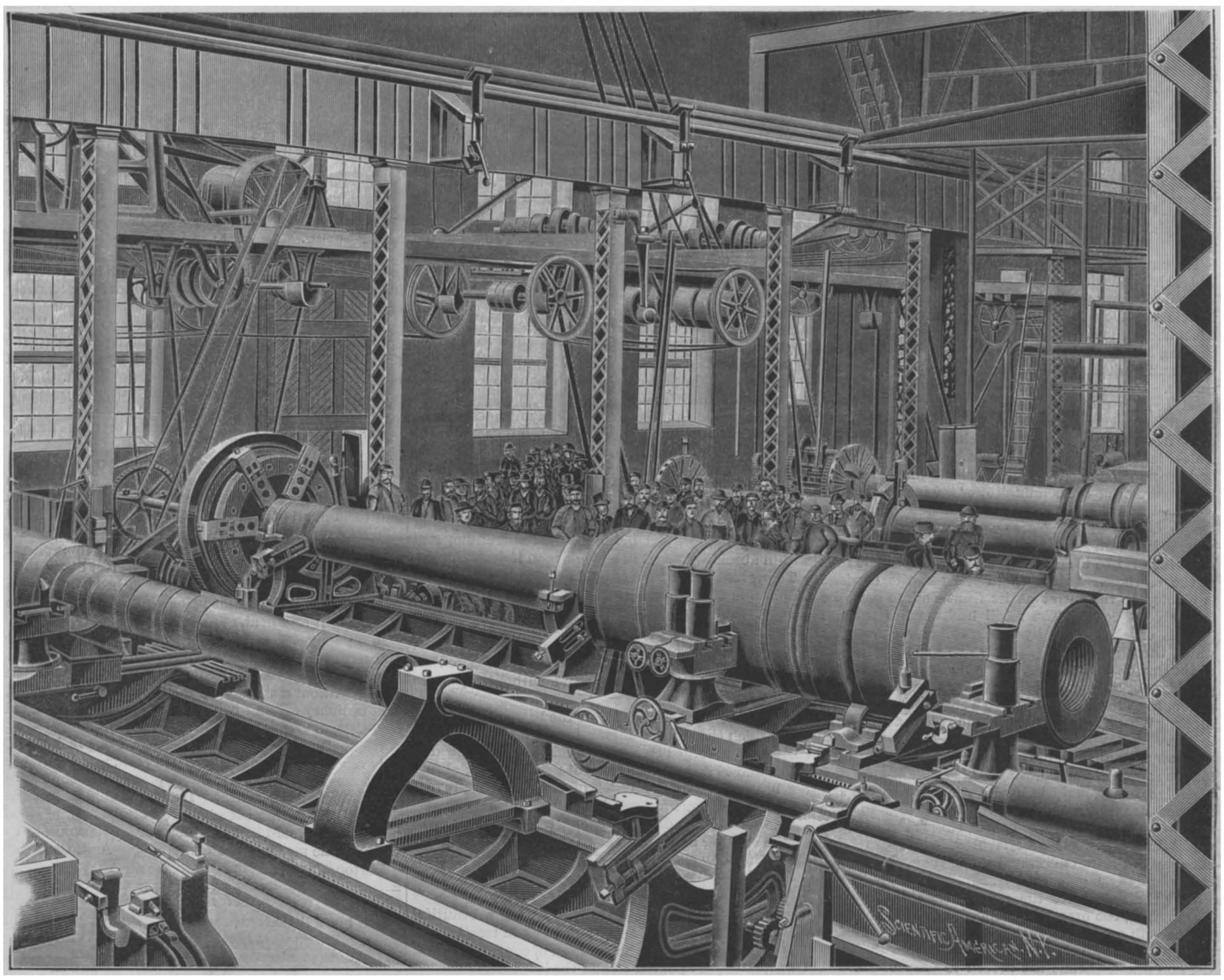
The rifling is effected in a machine carrying a bar whose cutting head operates during withdrawal, various devices being employed for regulating the twist or inclination of the grooves. The rifling is right-handed and the grooves are wider at the origin than at the muzzle. The breech is closed by the interrupted screw system. The factory is now well provided with the necessary boring and turning lathes, planers, slotters, shapers, and milling machines, drills, rifling machines, etc., which must each do their share in the work required upon the modern gun.

Nickel Coating on Platinum or Silver.

The following (says *La Metallurgie*) is the method of nickel-coating platinum, silver, or alloys of these metals adopted by the Societe de Laminage du Nickel, France. The metals to be united to each other should be in the form of plates or wires, the surfaces of which must be as clean as possible. The nickel should, moreover, be in such a condition of malleability that the hammering or rolling which completes the welding should perfect the intimate conjunction of the metals. The surfaces to be united are powdered by a welding material, such as borax, and the two pieces are afterward subjected to a suitable welding temperature; they are finally united by hammering or rolling. In order to insure a successful conjunction, the surfaces to be welded should be prevented from coming in contact with the air, which would oxidize the nickel in its red hot state. For this purpose, a method (one of several) may be employed which consists in enveloping at the outset the metals to be joined by thin metallic sheets. When, after suitable heating and hammering, the metals are welded, the protective sheet can be removed by pickling, scouring, or other method. With the view of preventing the soldering of the protective sheet on the metals to be welded, it has been found advantageous to coat the interior surface of the protective sheet with a deposit of magnesia, lime, oxide of zinc, or other substance having the same properties, in order to obviate interior contact of the protective sheet with the metals to be welded. When the welding is finished, the protective sheet can easily be removed. Plates and wire obtained in this manner are adapted for the manufacture of receivers and utensils used in pharmacy, chemical laboratories, and certain industries, owing to their perfect resistance to the action of acids and alkalies.

Discovery of Planets by Means of Photography.

Dr. Wolf, of Heidelberg, has discovered two minor planets by means of photographic plates taken on December 22 and 23. One of these is new (No. 323), but the other is probably identical with Sapientia (No. 275), which has only once been observed, in opposition. Since Dr. Wolf's discovery the two planets have been watched by Dr. Palisa at Vienna. The art of stellar photography has made rapid strides of late years, and has now become a powerful instrument in astronomical research. It has been expected that new planets would be discovered by this means, since, if two photographs of the same region of the heavens be taken at different times, upon comparison, a planetary body will betray itself by its movement with regard to the fixed stars in the interval, or, if a single plate be exposed long enough, the planet will, by its movement, trace a "trail" upon the plate, whereas the images of the stars will be dots, the telescope being driven by clockwork so as to keep them always in its field as they apparently revolve around the earth in consequence of the diurnal motion. The mean places for 1891 of the two planets found by Dr. Wolf are (1) 6 h. 38 m. 42·28 s. + 24° 47′ 0·3″, and (2) 6 h. 49 m. 30·64 s. + 18° 37′ 5·33″.



BORING, TURNING, AND CHAMBERING HEAVY GUNS AT THE WASHINGTON GUN FACTORY.

THE preliminary survey of the Hawaiian cable has been nearly completed. The Albatross has laid out a line from Salmas Bay across the Pacific, and after taking in a supply of coal made a return trip, the progress of which was interfered with by rough weather and interrupted by a lack of fuel. The vessel put in at San Francisco, and on January 6 proceeded to sea again to complete the survey of 600 miles. The line laid down by the Albatross on its outward trip is slightly north of that laid down by the Tuscarora fifteen years ago. Several submarine peaks were encountered, but the bottom is for the most part regular and suitable for the bed of a cable. The report of the return surveys of the Albatross has not been received at the Navy Department, and as soon as the information is in hand, the results will be plotted.

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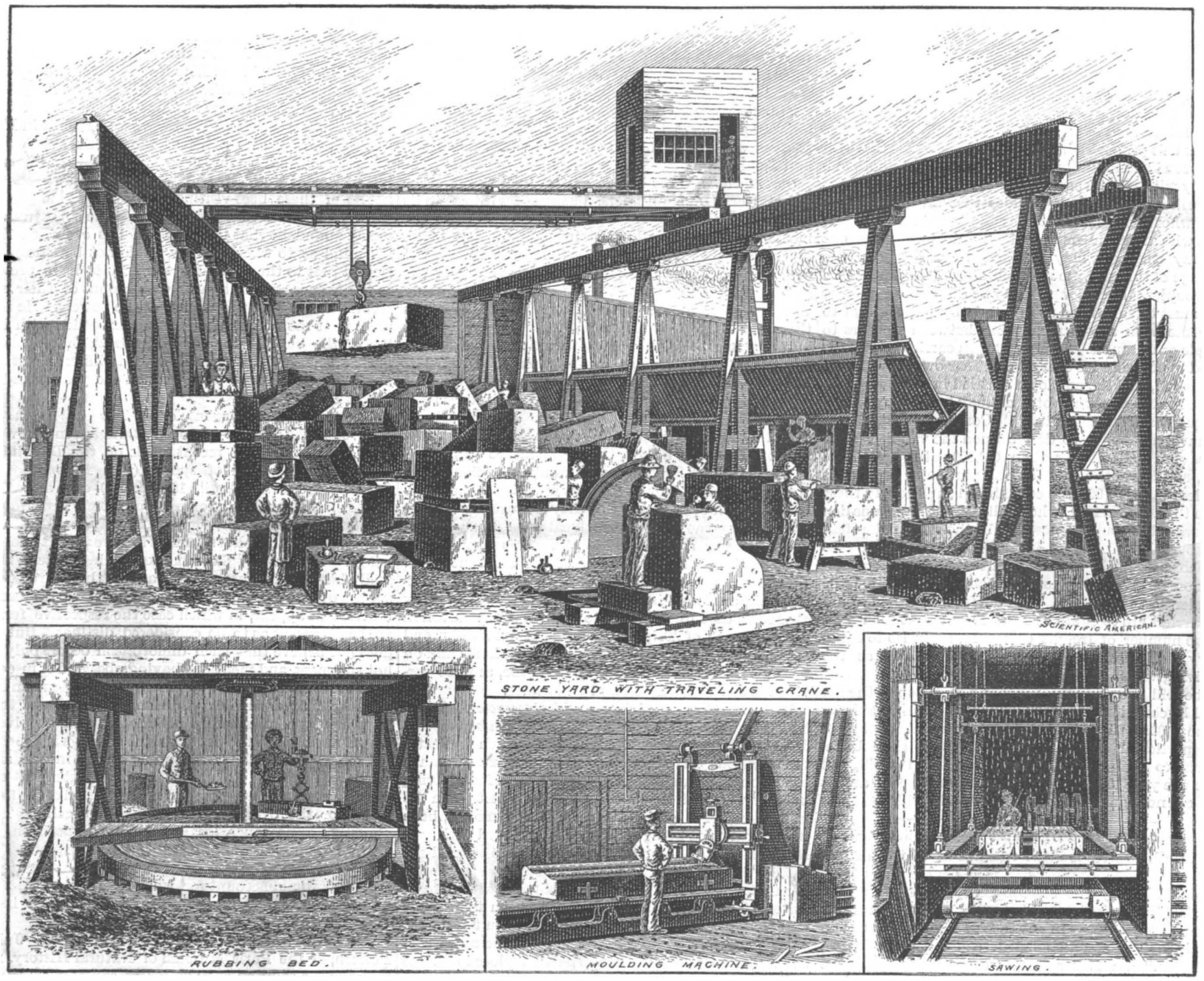
STEAM STONE WORKS.

The illustrations of this subject are taken from the plant of Barr, Thaw & Fraser, Hoboken, N. J. The elevated track is about 20 feet in height and 150 feet in length, and made mostly of 12 by 12 timber. The traveling crane is also made of 12 by 12 timber, and braced with heavy circular rods. It is 52 feet across from side to side and 12 feet in width. Connected to the end of crane are two 3 foot car wheels, which, when set in motion, run back and forth on steel rails. The crane is set in motion by means of an endless wire cable. The ¾ inch cable passes around a 6 foot sheave wheel, which is connected to the main shafting. The upper wire of cable runs up through the bottom of the building on the end of crane and around another 6 foot wheel, and down and out again to the 3 foot sheave wheel at the end of elevated track, where it passes back again to large wheel on the main shafting. The large sheave wheel in the crane building is connected to a piece of shafting, which, by means of belting, connects with the car wheels. By drawing a lever back and forth, and the wire being continually in motion, the shifting of the belting caused by the moving of the lever causes the crane to move backward or forward. The carriage and fall blocks run on 3 foot tracks across the center of crane, and are moved back and forth by wire cables also. These wires are attached to two drums in the crane building. One of the drums is used for drawing the carriage block back and forth by means of a 3 foot sheave wheel on the end of crane. The other drum is used for hoisting the stone. The crane is made to run evenly by means of gearing wheels, one being attached to one of the forward car wheels, and the other to a piece of shafting which runs across the crane and connects with the machinery in the building. The crane is capable of carrying from 15 to 20 tons.

The rubbing bed is a circular sheet of cast iron about 3½ inches in thickness and about 13 feet in diameter. It revolves around inside of a circular wooden frame called a curve. The rubbing bed when put together is in two pieces. Cast to the bottom of the upright shaft are a number of flanged arms, which project out 7½ feet each way. The rubbing bed is laid on and bolted on the under side to these arms. The lower end of the upright shaft revolves around in a ball socket. The upper end is geared to the main shafting. The blocks of stone are placed on the bed by hand, or by a small derrick, until the surface of the stone is smooth. Water and sand is used for the rubbing. Hot water is used when the weather is cold. The tools for moulding and grooving are of various shapes, generally chisel shaped, and are made of steel. They run from 8 to 12 inches in length.

The rough stone is first placed on the perforated iron table of the moulding machine and made perfectly fast by means of wooden wedges. The machinery is then started and the table and stone move forward, and the chisels begin to cut out their work. As they cut, the stone crumbles up into powder and small chips. After the chisels have gone over the stone the table is run back, the chisels shifted, and the stone started again. The chisels can be regulated to cut shallow or deep. The face of the stone becomes perfectly smooth after the chisels have gone over it. The stone blocks to be sawed are first placed on a car and run under the sawing shed. The cars are about 1½ foot in height, about 5 feet in width, and about 8 feet in length. They are put into position and then blocked fast. An 8 by 13 foot saw frame is then lowered so that the saws rest on the stone. The saws are made of ¼ inch steel, and are 13 feet in length and about 6 inches in width. They have no teeth, being flat both top and bottom. Connected to the center of one end of the saw frame is a wooden connecting rod, with crank and fly wheels. This connects with the main shafting by means of belting. When the wheels revolve, the connecting rod draws the saw frame back and forth, and the weight of the frame causes the saws to cut. A little sand and shot or crushed steel keeps the saw biting until the stones are sawed through. Water is kept constantly running on the stone by means of a perforated iron pipe placed about 4 feet above and across the stone. This pipe has the same motion as the saw frame when running, keeping the whole surface of the stone wet. When the stone is sawed through, the frame is raised by means of a belt chain. The stone is then washed clean, and the car drawn out to be replaced by another. The works are run by a 45 horse power engine, with 80 pounds steam. The plant cost about $30,000.



ILLUSTRATIONS OF STONE CUTTING, SAWING, AND POLISHING.

The Deadly Alternating Current.

A peculiar fatality at a fire in New Orleans is thus described: The wind was blowing hard and made fire fighting a hard task. Chief O'Connor was in charge and was directing Matthew Hannon, a hoseman of Columbia, No. 5, who was playing a stream of water on the fire. The chief took the brass nozzle and continued pumping on the blazing debris, while Hannon went to recover his hat, which had blown off. About this time a telephone wire fell and hung down in the doorway. The chief paid no attention to it and continued pumping. Suddenly he struck the wire with the stream. The water proved to be an excellent conductor, for a current of electricity ran down the stream and the brass nozzle and through the chief. The telephone wire was crossed with an electric light wire. The chief for a few seconds was stunned. Meantime Hannon had secured his hat, and came back to continue his fight on the fire. Unconscious of his danger he bounded to the chief's side, and as he did so the swinging wire struck him on the shoulder. He cried, "Oh, my God!" and threw out his arms. The wire swung away from him, but rebounding came in contact with Hannon's left arm. The unfortunate man shrieked once more, and then, as if to throw the deadly wire from him, he grasped it with both hands, and without a moan fell face downward, dead. One thousand people saw Hannon die, and the ordeal was so terrible that the firemen were for a time demoralized.

Remedy for a Cold.

In the SCIENTIFIC AMERICAN of December 2, 1876, we published the following remedy, which a correspondent, who has derived benefit from it, asks us to reprint:

The medical journals, last spring, published repeatedly the formula for Dr. Ferrier's new remedy for cold in the head. As the season for that distressing malady is at hand, we print the recipe, which is:

Trinitrate of bismuth, 6 drachms; pulverized gum arabic, 2 drachms; and hydrochlorate of morphia, 2 grains.

This is used as a snuff, creates no pain, and causes, says the London *Lancet*, the entire disappearance of the symptoms in a few hours.

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The President on Car Couplers.

Railroad men of all shades of politics will find interest in the following extract from President Harrison's message:

"I have twice before urgently called the attention of Congress to the necessity of legislation for the protection of the lives of railroad employes, but nothing has yet been done. During the year ending June 30, 1890, 369 brakemen were killed and 7,841 maimed while engaged in coupling cars. The total number of railroad employes killed during the year was 2,451 and the number injured 22,390. This is a cruel and largely a needless sacrifice. The government is spending nearly one million dollars annually to save the lives of shipwrecked seamen. Every steam vessel is rigidly inspected and required to adopt the most approved safety appliances. All this is well, but how shall we excuse the lack of interest and effort in behalf of this army of brave young men who in our land commerce are being sacrified every year by the continued use of antiquated and dangerous appliances? A law requiring of every railroad engaged in interstate commerce the equipment each year of a given per cent of its freight cars with automatic couplers and air brakes would compel an agreement between the roads as to the kind of brakes and couplers to be used, and would very soon and very greatly reduce the present fearful death rate among railroad employes."

The *American Journal of Railway Appliances* discusses this proposition editorially, as also the bill which has been introduced by Senator Cullom, of Illinois, evidently with the purpose of carrying out the President's suggestions. This bill provides that all common carriers whose duties include the coupling of cars, and persons who are members of established organizations of railway employes, may within six months after the passage of this act vote upon the choice of an automatic car coupler. Such coupler may be of the vertical type, but must be so devised as to couple by impact, and to dispense with any person going between the cars to couple or uncouple. Every common carrier is to be entitled to one vote for every freight car owned, leased or controlled, and the employes entitled in the aggregate to one-third as many votes as may be cast by all the common carriers, the Interstate Commerce Commission to have the power to decide upon the validity of the votes cast. If not less than 600,000 votes have been cast, and the entire vote for any particular coupler is not less than 500,000, the commission shall certify these facts to the President, who shall issue a proclamation declaring the coupler chosen to be the standard safety car coupler for use in interstate commerce, and in case no choice is made the President shall appoint a commission of five competent persons to determine the coupler best to be used. The bill further provides that all carriers are to equip at least 10 per cent each year of the number of freight cars used, and also to equip every engine with the lower brake known as the "driving wheel brake."

The bill provides further that a violation of the act shall be considered a misdemeanor, and punishable by a fine of $500. The commission may extend the time to any particular company within which it shall be required to comply with the provisions of the bill, and after the year 1900 any company may refuse to accept any car not equipped as required by the bill.

Influenza a Hundred and Sixty Years Ago.

An Italian correspondent reminds us of the historic epidemic of influenza in Milan between the years 1730–33, described by the contemporary physicians, Drs. Gagliardi, Bellegatta, and Crivelli. The last named, a Milanese practitioner in advance of his time, found in the air the "chief and efficient cause of the influenza visitation." In 1730 and 1733 the climatic conditions were as nearly as possible the same as those prevalent in the last two epidemics in Italy; that is to say, a mild temperature, the sirocco wind predominant, and much humidity, with fog and rainfall alternating. Dr. Crivelli's description of the symptoms of an influenza patient might (our correspondent says) be transcribed from the phenomena of to-day:

"Gravedo and coryza, general languor with indisposition to exertion of any kind, loss of appetite even in presence of the daintiest viands, pain in the sinciput, giddiness, dimness of eyesight, high fever, with rigors and *horripilatio* extending over the whole body; cough sometimes moist, sometimes dry enough to induce a choking sensation."

These symptoms, not very grave in themselves, says Dr. Crivelli, are apt to reach an acute and even pernicious stage—"the patient finding himself suddenly oppressed with a suffocating catarrh (*un catarro soffocativo*), or, in other cases, with a pleurisy, or a pleuropneumonia. One patient falls as by an apoplectic stroke, another complains of intolerable cephalalgia—the old, the phthisical, the asthmatic, rarely outriding the storm." It would be difficult to give a truer account of the course and issue of the influenza cases now occurring at this hour in the Alta Italia. Dr. Crivelli further shows himself ahead of his age in his severe condemnation of indiscriminate venesection, stigmatizes the abuse of diluents, and rests his system of treatment on vigilantly regulated diet and the support of nature. Of course, he used heroic measures when time was precious—even blood-letting when engorgement of the circulation was a distressing sympton—and he found great efficacy in the Hippocratic prescription: "Alvus curanda est per clysterem subducentem et frigefacientem." Other less rational measures he also recommends, taken from a pharmacopœia happily superseded. But, according to the lights available at the time, he seems to have been a thoughtful and ingenious clinician, and his treatise has a quite special interest for the student of the history of medicine.—*The Lancet.*

Natural History Notes.

Animals and Steam.—In a German engineering journal a writer contrasts the behavior of different animals toward steam machinery thus: The ox, that proverbially stupid animal, stands composedly on the track of a railway without having any idea of the danger that threatens him; dogs run among the wheels of a departing railway train without suffering any injury; and birds seem to take a particular delight in the steam engine. Larks often build their nests and rear their young under the switches of a railway over which heavy trains are constantly rolling, and swallows make their home in engine houses. A pair of swallows have reared their young for a year in a mill where a noisy 300 horse power engine is working night and day, and another pair have built a nest in the paddle box of a steamer which plies during the season between Pesth and Semlin.

Observations on the Camel.—In a recent paper on the camel, Herr Lehmann refers, among other things, to its relations to temperature and moisture. Neither the most broiling heat nor the most intense cold nor extreme daily or yearly variations hinder the distribution of the camel. It seems, indeed, that the dromedary of the Sahara has better health there than in more equably warm regions; though, after a day of tropical heat, the thermometer sometimes goes down several degrees below freezing point, and daily variations of 90 degrees occur. In Semipalatinsk again, where the camel is found, the annual variation of temperature sometimes reaches 187 degrees. In Eastern Asia, winter is the time the animals are made to work. In very intense cold, they are sewed up in felt covers. Of course each race of camel does best in the temperature conditions of its home; a Soudan camel would not flourish in Northeast Asia. Camels are very sensitive to moisture. In the region of tropical rains they are usually absent, and if they come into such with caravans, the results of the rainy season are greatly feared. This sensitiveness expresses itself in the character of the different races. The finest, most noble-looking camels, with short silk-like hair, are found in the interior of deserts, and they cannot be used for journeys to moist regions. Even in Fezzan (south of Tripoli) the animals are shorter and fatter, with long, coarse hair; and in Nile lands and on coasts it is the same. These animals, too, are less serviceable as regards speed and endurance.

Water Beetles Found in an Old Gasometer.—An interesting note is published in the *Entomologist's Monthly Magazine* for March, 1890, which indicates that *Dytiscus marginalis* may live under extraordinary conditions. A number of specimens were found living in rusty water at the bottom of a hole left when the iron casing of a gasometer had been removed, both water and mud being strongly impregnated with gas. Mr. T. H. Hall, the writer of the note, who secured the specimens, states that they carried a strong odor of gas, even after they had had two or three baths of fresh water. The old gas holder must have been their home for a long period of beetle life, judging from the time of year when they were found and from the number of both sexes seen. The water was partly inclosed and was quite stagnant, being unconnected with any other water. They could have migrated had they desired to do so. They were quite active, and seem undoubtedly to have remained entirely from choice.

Composition of Chlorophyl.—Mr. N. Monteverde has made a series of experiments for the purpose of determining the number of distinct pigments present in an alcoholic solution of chlorophyl. If an alcoholic extract of green leaves is treated with baryta water and the precipitate extracted with alcohol, the solution has a yellow color. If this is again shaken with petroleum ether after the addition of a few drops of water, a separation takes place of the yellow pigments, the petroleum ether having taken up the carotin, identical with the coloring matter of the carrot, together with the green pigment, while the alcohol contains the xanthophyl. The pigments contained in the petroleum ether are termed by the author "upper pigments," those contained in the alcohol "lower pigments." By careful manipulation the whole of the green pigment (upper green pigment) can be removed by treatment with alcohol from the petroleum extract, leaving behind a golden-yellow solution of carotin; this "upper green pigment" is not capable of crystallizing. The alcoholic solution contains, in addition to xanthophyl, a "lower green pigment," which crystallizes in tetrahedra, hexagons, or stars, but most usually in irregular forms. The author believes that living leaves contain only the "lower green pigment," the "upper green pigment" being a transformation product resulting from the action of boiling water or of alcohol.

Duration of Life of Various Animals.—Elephants, 100 years and upward; rhinoceros, 20; camel, 100; lion, 25 to 70; tigers, leopards, jaguars, and hyenas (in confinement), about 25; beaver, 50; deer, 20; wolf, 20; fox, 14 to 16; llamas, 15; chamois, 25; monkeys and baboons, 16 to 18; hare, 8; squirrel, 7; rabbit, 7; swine, 25; stag, under 50; horse, 30; ass, 30; sheep, under 10; cow, 20; ox, 30; swans, parrots, and ravens, 200; eagle, 100; geese, 80; hens and pigeons, 10 to 16; hawks, 30 to 40; crane, 24; blackbird, 10 to 12; peacock, 20; pelican, 40 to 50; thrush, 8 to 10; wren, 2 to 3; nightingale, 15; blackcap, 15; linnet, 14 to 23; goldfinch, 20 to 24; redbreast, 10 to 12; skylark, 10 to 30; titlark, 5 to 6; chaffinch, 20 to 24; starling, 10 to 12; carp, 70 to 150; pike, 30 to 40; salmon, 16; codfish, 14 to 17; eel, 10; crocodile, 100; tortoise, 100 to 200; whale, estimated, 1,000; queen bees live 4 years; drones, 4 months; worker bees, 6 months.

The Bumble Bee in New Zealand.—The introduction of the bumble bee into New Zealand a few years ago to secure the fertilization of the red clover, and the remarkable success of this venture, are matters of record. In a recent paper in the *New Zealand Journal of Science*, noticed in the *Entomologist's Monthly Magazine* for May, 1891, Mr. George M. Thomson, F.L.S., presents an interesting article on the introduced Bombi in New Zealand, giving also a list of the plants and flowers which are visited by these bees. He makes the interesting statement that, with a few exceptions, he has never heard of these bees visiting the flowers of indigenous plants, but states that they have become so extraordinarily abundant that the question has even arisen in his mind as to whether they would not become as serious a pest to the apiarist as the rabbits have proved to the farmer and cultivator, on account of their absorbing so much of the nectar of the flowers. He also points out the remarkable fact in connection with the life of the bumble bee in New Zealand, that in many parts of the colony it does not seem to hibernate at all, but is to be seen daily on flowers all the year round.—*Insect Life.*

Occasional Development of Wings in Normally Apterous Hemiptera.—Mr. J. W. Douglas, in a review of Mr. F. B. Pascoe's recent work on the Darwinian theory of the origin of species (*The Entomologist's Monthly Magazine*, April, 1891, p. 109), calls attention to the statement that "some of our Hemiptera, *Nabis*, *Pithanus*, *Pyrrhocoris*, etc., ordinarily wingless, are sometimes found in hot summers to have well developed wings." As Mr. Douglas remarks, all these species normally have rudiments of elytra, but there are other species quite apterous in which at times macropterous individuals appear, in which case the respective forms are so divergent as to be considered distinct. But he does not believe that such dimorphism occurs only in hot summers, and mentions having observed it in cold seasons also, when there was nothing exceptional in the weather to favor such development. He believes that at present no satisfactory explanation can be given. May it not be that the development of wings is dependent somewhat on the food supply of the insects, and they are produced to enable a more extended migration, rendered necessary by a diminution of the food supply or the overdevelopment of the species? The abnormal appearance, locally, of winged specimens of a wingless species cannot be satisfactorily explained by the theory of a reversion to a winged ancestral type, since this would account for isolated cases, but would hardly explain the general appearance of winged individuals.—*Insect Life.*

Preservation of Botanical Specimens.—Mr. Jules Poisson, of the Paris Museum of Natural History, recommends a solution of 30 grains of salicylic acid in 1 quart of water for the preservation of specimens of plants in their natural form and color.

Ether as an Assistant of Digestion.

The effect of ether on the digestive processes in healthy subjects has been recently investigated by Dr. Gurieff, who gave thirty drops of sulphuric ether to six healthy persons during dinner, which consisted of about half a pint of soup, four ounces of meat, and six ounces of bread. It was found that the ether had the effect of stimulating the action of the gastric glands, increasing the free hydrochloric acid in the gastric juice, and causing the peristaltic movements of the stomach, together with its power of absorption, to increase; thus on the whole exercising a favorable effect upon the gastric digestion. The same result was obtained when the ether was administered by means of hypodermic injections. It would appear, therefore, that the effects must be ascribed to a general rather than to any merely local action on the mucous membrane of the stomach. Dr. Gurieff is disposed to think that there is a stimulation of the cephalic centers. This view is partly based on the observations of other Russian observers—Bekhtereff and Miloslevski, and Pavloff and Shumova-Simanovskaya—on the dependence of the gastric functions upon the central nervous system.—*Lancet.*

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What is Electricity?

The average man will be glad to know that such an authority as Prof. William Crookes, President of the Institution of Electrical Engineers, England, is yet in doubt as to the various theories advanced to explain the electric phenomena. He says: "We know little as yet concerning the mighty agency of electricity." In his recent presidential address there is much of interest to the engineer, and we quote the following from the *Railroad Gazette:*

"We have happily outgrown the preposterous notion that research in any department of science is mere waste of time. It is now generally admitted that pure science, irrespective of practical applications, benefits both the investigator himself and greatly enriches the community. 'It blesseth him that gives and him that takes.' Between the frog's leg quivering on Galvani's work table and the successful telegraph or telephone there exists a direct affiliation. Without the one we could not have the other.

"We know little as yet concerning the mighty agency of electricity. 'Substantialists' tell us it is a kind of matter. Others view it, not as matter, but as a form of energy. Others, again, reject both these views. Prof. Lodge considers it 'a form or rather a mode of manifestation of the ether.' Prof. Nikola Tesla demurs to the view of Prof. Lodge, but thinks that 'nothing stands in the way of our calling electricity ether associated with matter, or bound ether.' High authorities cannot even yet agree whether we have one electricity or two opposite electricities. The only way to tackle the difficulty is to persevere in experiment and observation. If we never learn what electricity is, if, like life or like matter, it should remain an unknown quantity, we shall assuredly discover more about its attributes and its functions.

"Experimentalists are reducing the wave lengths of the electrical rays. With every diminution in size of the apparatus the wave lengths get shorter, and could we construct Leyden jars of molecular dimensions, the rays might fall within the narrow limits of visibility. We do not yet know how the molecule could be got to act as a Leyden jar, yet it is not improbable that the discontinuous phosphorescent light emitted from certain of the rare earths, when excited by a high tension current in a high vacuum, is really an artificial production of these electrical rays, sufficiently short to affect our organs of sight. If such a light could be produced more easily and more regularly, it would be far more economical than light from a flame or from the arc, as very little of the energy in play is expended in the form of heat rays. Of such production of light, nature supplies us with examples in the glow worms and the fireflies. Their light, through sufficiently energetic to be seen at a considerable distance, is accompanied by no liberation of heat capable of detection by our most delicate instruments.

"Alternating currents have at the best a rather doubtful reputation, but it follows from Tesla's researches that as the rapidity of the alteration increases they become not more dangerous, but less so. It further appears that a true flame can now be produced without chemical aid—a flame which yields light and heat without the consumption of material and without any chemical process. To this end we require improved methods for producing excessively frequent alternations and enormous potentials. Shall we be able to obtain these by tapping the ether? If so, we may view the prospective exhaustion of our coal fields with indifference. We shall at once solve the smoke question, and thus dissolve all possible coal rings. . . . Electricity seems destined to annex the whole field, not merely of optics, but probably also of thermotics. . . . Rays of light will not pass through a wall, nor, as we know only too well, through a dense fog. But electrical rays of a foot or two wave length of which we have spoken will easily pierce such mediums, which for them will be transparent."

The Physiology of Tears.

This subject is considered in a bright and interesting paper recently published in the *Asclepiad.* The editor of the New York *Medical Journal* condenses from the lengthy article as follows:

Fear, grief, and joy, to say nothing of pathos and anger, bring tears to the eyes. They are said to come from the heart: and this is true, for no one ever reasoned himself into weeping without a first appeal through the imagination to some emotion. Tears are the natural outlet of emotional tension. They are the result of a storm in the central nervous system, giving rise to changes in the vascular terminals of the tear-secreting glands. These changes induce profuse excretion of water, and weeping results. In a mild degree some excretion is always in process, to bathe eye and clear it of foreign matters. The controlling center is at a distance, though the secretion may be kept up by the small trace of saline substance that is present in the tears themselves. The lachrymal glands lie between the nervous center and the mucous surface of the eyeball. Tears afford a good illustration of the way in which nervous fibers are capable of conveying to a secreting organ exciting impulses from both sides of a gland lying in their course. Afferent and efferent communications bring about a similar result. Internal nervous vibrations and external excitation or reflex action cause a flow of tears. In both instances the exciting impulse is a vibration. Niobe, "all tears," and the unfortunate pedestrian with a minute particle of steel from the rail of an elevated road in his eye, are unwilling exponents of a similar process. They weep the same kind of briny fluid, in exactly the same way, though from widely different causes. Imagination is at times sufficient to excite the nervous system into the production of tears, without external aid or reflex. Writers and readers of good fiction weep over it alike, and the actor loses himself so entirely in the exigences of dramatic art that he sheds real tears and the audience shed tears with him. Of a truth, the man who never weeps has a hard heart, and the quality of his intellect may also be questioned.

Emotion, then, affection, grief, anxiety, incite to tears, not pain or discomfort. The pangs of maternity are tearless, though the influence of ether or chloroform may cause some emotional dream that results in weeping. In the earlier days of surgery patients might scream and utter such pitful cries as to sicken the bystanders, might even faint with pain, yet there were seldom any tears. These, being pure waves of emotion and a relief to the heart, are almost powerless to mitigate pain. Perhaps one who weeps from pain does so from unconscious though selfish pity—in other words, from emotion.

For the tearful, change of scene, mental diversion, and out-door life are the best remedies. The author quoted objects to alcohol as fearfully injurious. It disturbs and unbalances the nervous system, keeps up a maudlin and pitiful sentimentality, and sustains the evil. Alcohol is the mother of sorrow. An opiate, however, prescribed at night, soothes and controls and really disciplines rebellious nerve centers. Sleep cures tears. And so does time, the restorer. Persons subjected to many and repeated griefs forget how to weep, and the old as compared to the young are almost tearless. Tears have their value in the life of humanity, not as tears but as signs. They show that grief centers are being relieved of their sensibility, and that the nervous organization is learning how to bear up against sorrow.

Poisonous Metals in Preserved Foods.

The fact that the amount of lead in the tin coating of vessels for preserved foods, and that in the solder with which they are united, have been limited by law in Germany to 1 per cent and 10 per cent respectively, has caused the adoption of vessels closed without a soldered joint, a rubber ring being substituted instead. The author having observed that preserved foods contained in vessels of this description, which appeared unexceptionable, were often contaminated with lead, has examined into the cause of its presence, and finds it to be due to the rubber ring employed.

The following examples are chosen from among the figures quoted by him: (1) India rubber rings made in Paris and used by a large German firm, (*a*) average weight of ring, 0·5 grm.; ash 66·6 per cent, consisting almost wholly of red lead; no antimony sulphide was present. (*b*) An experiment was made by exposing a rubber ring to water under pressure at a temperature of 110° to 112° C. for thirty minutes; at the end of this time the ring was found to be softened and 0·0286 grm. red lead (misprinted Mn_3O_4 in original) was suspended in the water, which contained no lead in solution. (*c*) Another ring was similarly treated in the presence of 0·5 kilo. of asparagus. The solution gave an immediate precipitate of lead sulphate on the addition of sulphuric acid; the quantity of lead in solution corresponded to 60 per cent of the total amount in the ring. (2) India rubber rings taken from tins of Australian meat from a large English firm had the same composition as those mentioned under (1). (3) Red rubber rings from Vienna contained 63 per cent of ash, the bulk of which was red lead. (4) Red rubber rings from a German factory gave similar results, save that a little antimony sulphide was present. (5) Numerous analyses of rings from other German firms gave similar figures.

In view of these facts the author is interesting himself in the manufacture and use of rings of a less poisonous character.—*W. Reuss, Chem. Zeit.; Analyst.*

American Salt.

The total production of salt in the United States for the year 1891 was 10,229,691 barrels, valued at $5,872,186. The importations were about 800,000 barrels, chiefly from England.

The finest salt is made by the vacuum pan process. About four-tenths of the American production are due to Michigan, four-tenths to New York, not quite one-tenth to Kansas, and the remainder to Ohio, West Virginia, Louisiana, California, Utah, Nevada, Texas. Perhaps the most wonderful deposit of salt in this country is at Petite Anse, La., where, at a depth of sixteen to twenty-five feet below the surface, a deposit of salt over 1,000 ft. thick is found. This salt is of remarkable purity.

The Census of 1891 in Canada.

According to the Canadian Census Department the population of Canada, by provinces, is as follows:

		Percentage of Inc.
Nova Scotia	450,523	2·25
New Brunswick	321,294	0·02
P. E. Island	100,088	0·18
Quebec	1,588,856	9·53
Ontario	2,112,989	9·95
Manitoba	154,442	148·06
Assini boia, Alberta, Saskatchewan	67,554	164·76
British Columbia	92,767	87·56
Unorganized	32,168	4·00
Total	4,829,411	11·66

THE TEN LARGEST CITIES.

		Inc. p. c.
Montreal	216,650	39·5
Toronto	181,220	88·4
Quebec	63,090	1·0
Hamilton	48,980	36·2
Ottawa	44,154	41·0
St. John	39,179	5·2
Halifax	38,556	6·8
London	31,877	21·7
Winnipeg	25,642	221·1
Kingston	19,264	36·7

There are 47 cities, their population varying from 216,650 at Montreal to 5,042 in Port Hope; 45 towns having from 4,940 (at Collingwood) to 3,061 (at Walkerton); 91 villages, headed by Picton, N. S., with 2,999, and Georgetown at the foot with 1,509.

The Trust Fallacy.

Trusts are not a creation of modern times by any means. They have existed at least from the beginning of the present century, or, rather, they have attempted to exist during the period named, but, as a rule, signally failed. A partisan writer, in an article that recently appeared in one of the largest and most influential newspapers in the country, attempted to show that trusts were a good thing for the public. At the outset he argued that trusts could by no means injure the small manufacturers, for the reason that they could dispose of their plants and become shareholders in the trust. He therefore claimed to be puzzled to understand why it was that the people protest so vigorously against such combinations of capital. He further argued that the consumer was really benefited by the formation of a trust, and upon this point it is interesting to dwell, for the simple reason that it has never been made clear to the general public why the average trust reduces prices upon the production it has cornered, immediately upon its formation. In completing a great trust all of the stronger manufacturers are invited to join; then the weaker ones are given an opportunity to sacrifice their property or to be driven out of business. Self-preservation is the first law of nature, and it is the most natural thing in the world for these smaller manufacturers to fight back. The trust is all-powerful, with millions at its back, and in order to silence the weaker enemy's guns, prices are put at a figure below the cost of production, and the smaller manufacturers go to the wall. During the battle there is no question but what the public profit largely, or could profit largely, if it took advantage of existing prices, and bought up all the products in sight. That is just what the public does not do, however, and when the trust has crushed all opposition out of sight, up go prices and the consumer finally pays back into the treasury of the trust the money it has expended in crushing those who dared to oppose it. There is really no argument that can be adduced favorable to a trust. A trust is an entirely different thing than a combination of capital. It is the coming together of all the powerful wings of a certain industry, to crush out the weak, and monopolize certain productions in order that it may fix prices as it pleases. The proposition trusts are formed in order to benefit the consumer is so ludicrous that it is scarcely worth considering. The writer endeavored to make a point to the effect that a trust was not a profitable thing after all, by stating that Standard Oil paid but 6 per cent dividend. Now the fact of the matter is that in recent years the Standard Oil trust has paid not less than 10 per cent, and last year paid 12 per cent dividends upon the capital invested.—*Stoves and Hardware Reporter.*

Cork Pavement.

A new material for paving is now being introduced into London. It is composed of granulated cork and bitumen pressed into blocks, which are laid like bricks or wood paving. The special advantage of the material lies in its elasticity. When used for pavement it gives a soft tread which is exceedingly pleasant, recalling the feel of a carpet. In roadways it furnishes a splendid foothold for horses, and at the same time almost abolishes the noise which is such an unpleasant feature of city traffic. A short piece of pavement is to be seen in Liverpool Street, E. C.; while the outlet to Pickford's yard in Gresham Street is laid with this material. It yet remains to be seen how it will bear the ordinary traffic of a London street, but there is evidence to show that in Australia short pieces of roadway have given good results.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR SEAL.—Benjamin J. Sturtevant, St. Paul, Minn. This seal is formed of a flexible shackle to which is detachably secured a hook having a spring-pressed arm, a locket made of earthenware, cement, glass, or similar substance, having on one side a shoulder to engage the arm of the hook. The device affords an inexpensive seal, which must necessarily be broken if the door is opened, thus indicating that the car has been tampered with, while it may easily be applied and removed without the use of special tools, but cannot be opened except by breaking the shackle of the locket.

CAR COUPLING.—Francis A. Johnson, Black Rock, Ark. The drawhead of this coupler has a transverse partition in the front end of its central opening, spring-pressed plates sliding transversely in the rear of the partition, pivoted arms being connected with the plates and a cam actuating the arms to open the plates, while rods are pivotally connected with an arm on the shaft of the cam, hooks engaging the rods to lock them in place. The device is an improvement on a former patented invention of the same inventor, and the essential working parts are inclosed in the drawhead, to be fully protected from rain, snow, ice, dirt, etc., thus insuring the proper working of the device at all times.

CAR COUPLING. — Oliver M. Brimingham, Victoria, Texas. This invention provides a drawhead to which is attached a guiding block in which works a vertically movable sliding frame, the pin being connected with the frame and having a guiding tongue working in the guiding block. The improvement affords means for elevating, holding and releasing the coupling pin, while the drawhead is vertically adjustable in a convenient manner either before, during, or after coupling. The device is designed to be arranged to be operated from either side of the car. [For information relative to this patent address R. Brackin, Inez, Texas.]

DRILL. — Wanton C. Barber, Villisca, Iowa. This is a portable drill of simple and durable construction, especially adapted for use in drilling railroad rails, while capable of satisfactory use on many portions of a locomotive or upon stationary engines. The bed has guides and a shifting lever, a frame sliding on the bed holding a mandrel carrying a drill, while a driving mechanism and feed device are connected with the drill mandrel. Arms extending from the bed have hooks adapted to clamp the tread of a rail, when the web of the rail is to be drilled, and the frame is fed forward by manipulating a lever, and when the drill is in operation it is automatically fed forward while being revolved by the driving mechanism.

Mechanical Appliances.

NAIL MACHINE. — Joseph S. Blackburn and Frank G. Bartholomew, Salem, Ohio. This machine has the usual fixed anvil or die, on which operates the hammer fitted to slide in the usual manner in the frame, but combined with the movable hammer is a spring-pressed arm pivoted on the machine and extending at its free end to the hammer, the latter actuating the arm. With this improvement, after the nail is formed with a head and cut by the knives, it is readily broken off the wire and discharged.

CORE SAW. — Edwin B. Roberts, Emporia, Kansas. The body of this saw consists of a cylinder adapted to be clamped to the head of a vertical shaft, the inner faces of the teeth being flush with the interior wall of the body, and each tooth being cut away beneath its gouge-like point from its outer face inward, an inner wall being formed to prevent chips entering the interior of the body, while there are spiral ribs or bands on the outer side of the body flush with the outer sides of the teeth, the upper or working edge of the body being beveled between the teeth. The saw is designed to be driven rapidly for any desired distance into the wood without clogging, the chips passing through recesses of the teeth and head and the spiral bands carrying them to the bottom of the saw.

ORE CRUSHING MILL. — William H. Coward, Bath, England. This invention provides improvements in a formerly patented mill in which an edge runner rolls within a revolving drum furnished with cups, by which the material is repeatedly brought under the action of the edge runner, the efficiency of the mill being increased by an improved mode of mounting the drum, more effectually exposing the crushed material to the winnowing action of the air current. The draught arrangement is such that sieves may be dispensed with over the exhaust aperture, the sieves being liable to become clogged by light particles in operating on micaceous ores.

Agricultural.

CULTIVATOR. — Adam F. Rinehart, near Uniopolis, Auglaize County, Ohio. Pivotally connected at its rear end with the main frame of this cultivator is a swinging frame, with which is connected a lever imparting a lateral movement to the front portion of the frame, while a blade or tooth beam also has a pivotal connection with the swinging frame. Various other novel features are embodied in the invention, forming an implement of simple, strong and inexpensive construction, and of light draught, which can be managed to plow to a uniform depth. The cultivator teeth or blades are under the complete control of the driver, and may be adjusted both vertically and laterally as occasion may demand.

CULTIVATOR.—Dillyard Hicks, Waldo, Fla. This implement is adapted to have attached thereto plows of any make, such as scooters, shovels, sweeps etc., and is designed to be economically manufactured. Two parallel cross beams extend diagonally across and are secured to the draught beam, one of them carrying cultivator blades, while from the rear one curved braces project forwardly and downwardly, engaging at their lower ends the supports of the cultivator blades. Vertical brace bars are provided whereby the cross beams are sustained against lateral strain and the main connections between the cross beams are preserved against undue tension.

HAY LOADER. — Henry Briscoe, Morrisonville, Ill. This machine, besides the carriage and framing, has an elevator with a rake frame held in inclined position, so that as the machine moves forward the teeth rake up the hay, which is delivered into an upper trough, from which it is discharged by means of a transverse carrier into a wagon moving alongside of the machine. The rake teeth may be conveniently raised or lowered, and the carrier has a hinged outer section which can be readily adjusted as desired.

Miscellaneous.

GALVANIC BATTERY.—Fernaud Gendron, Bordeaux, France. This is an improved primary battery, so formed that the output of the battery is regulated automatically according to the work demanded of it, to the greatest amount of work the battery will do. It consists of a series of cells containing exciting and depolarizing liquids in combination with an electric motor actuated by a portion of the battery elements, pumps driven by the motor producing a circulation through the cells, while there is an automatic regulator of the number of cells in use. The battery is preferably formed in three tiers, comprising six tanks for liquids and twenty-four elements, the nature of the elements having no bearing on the invention provided the exciting liquid and the depolarizing liquid be separated from one another in the cells.

CASH RECORDER. — Milo L. Morgan, New York City. This is a device for use in connection with a cash drawer and the top of a table or desk, a tape from a roll of paper having a section exposed for writing upon each time the drawer is opened, so that an entry may be made thereon each time a sale is effected. The paper is held at all times stretched smooth in position for use, there being a rigid connection between a trip lever actuated by the drawer and the feed wheel, the device affording the means of readily making up accounts at the end of a business day.

SPECTACLE CASE FASTENING. — Fredric W. Steadley, Carthage, Mo. This device is formed with a plate having a central aperture in which is swiveled an eye with elongated bearings in which turns and slides the rigid member of a safety pin, for fastening the device to the clothing. The fastening is designed to readily adjust itself to the body of the wearer when bending over, stooping, etc., the securing pin having a free movement relative to the case.

CAN COVER. — Orson D. Phillips and George H. Littlewood, Lisle, N. Y. This improvement provides a locking device, especially adapted for use with milk cans, etc., and adapted as a fixture to the can body, which may be engaged with the lid to quickly and conveniently clamp the body of the lid to the body of the can, and hold them locked together. The device is preferably made of spring wire, bent in essentially circular shape, but with a coil, eyes, and loops, with which is connected a link, on which a lock may be placed if desired, the link serving as a lever to draw the ends of the device together and as a bolt to maintain the ends in such position.

LOAD BINDER. — Harry M. Bradley, Canon City, Col. This device consists of a bar having teeth on its upper and lower edges and provided at one end with means for attaching a cord or wire thereto, a slotted lever receiving the ratchet bar being provided with a bolt extending through the slot to engage one set of teeth of the bar and a pawl engaging the other set of teeth, while a hook is provided to receive a cord, wire, or cable. The device is designed to afford a simple, cheap, and efficient means by which a load of any kind may be tightly bound, while it is also well adapted for use as a wire tightener, post puller, lifting jack or wagon jack, etc.

VEHICLE SPRING.—Thomas S. King, Cincinnati, Ohio. This spring is made from a single strip of metal, bent to the desired shape, and joined at its ends in the flat portion of the spring by riveting or other suitable fastening. The upper and lower sections are integral, but elongated bends at the end portions form rounded ends, the drawn-in portions of which come together when the spring is much compressed, whereby the spring is shortened and stiffened, although when a light load is on, the entire length of the sections and the end portions are in full play.

STOVE PIPE DRUM. — Moses P. Farnham, Germantown, Cal. This is an end-closed stove or furnace pipe drum having upright partitions of different heights establishing flues between them, with a central through draught pipe having upper and lower draught openings and an intermediate damper, while the lower head of the drum has a soot or ash clearance hole exterior of one side of the through draught pipe, and a door is arranged to form a clearance outlet for two adjacent flues. The invention is an improvement on a former patented invention of the same inventor, the drum being adapted to facilitate various heating purposes.

GAME BOARD.—Jacob M. Henriquez, Coro, Venezuela. This is a board adapted for playing a variety of games. The base of the board is divided into compartments, and there is in it a tilting table which actuates a rocking slide board, there being a vertical tubular conduit on the base, with branch receiving pipes at its upper end and branch delivery pipes at its lower end, and a central vertical diaphragm in the conduit at the junction of the delivery pipes. Balls dropped through the upper branch pipes are designed to tip the tilting table and dislodge a counter from the slide board.

TOY PUZZLE. — Hans I. F. Schulze, New York City. This toy is designed to exemplify the problem of standing an egg on end, and consists of an egg-like hollow body formed in two sections, its chamber divided into two compartments by a horizontal partition, there being another apertured horizonal partition in the lower chamber, and the body containing a movable weight. By properly manipulating the toy the weight or ball may be made to travel down inside to the pointed lower end, when the egg-like body will be balanced upon this end.

NOTE.—Copies of any of the above patents be will furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE LUMBERMAN'S HANDBOOK OF INSPECTION AND GRADING. By W. R. Judson. Chicago: *The Lumberman.* 1891. Pp. 263.

This excellent work covers the ground of quality and inspection of lumber in different parts of the United States, with many useful notes on dimensions, cutting up of lumber, and other allied topics. The book represents the fourth edition. It will be very acceptable to all those concerned with wood and lumber.

THE PHOSPHATES OF AMERICA. By Francis Wyatt, Ph.D. Second Edition. New York: The Scientific Publishing Co. 1891. Pp. 187. Illustrated. Price $4.

Much interest has been created in the subject of phosphates by the recent discoveries of the phosphate beds of Florida. Dr. Wyatt, in this very elegantly made volume, treats of phosphates from the mine to the farm. Their extraction, chemical treatment, analysis and the allied industries receive due consideration. The illustrations, many by process from original photographs, are exceedingly attractive and add greatly to the value of the book. Curiously enough, although it is the second edition, it is destitute of a table of contents. It has, however, an excellent index.

MODERN AMERICAN RIFLES. By A. C. Gould ("Ralph Greenwood"). Illustrated. Boston: Bradlee Whidden. 1892. Pp. xii, 338. Price $2.

This excellent book goes over the whole range of rifle practice, hunting and target practice, both civilian match and military shooting. The different forms of rifle sights, the general construction of the piece, the rifling, projectiles, cartridges, and ammunition, are all elaborately treated with many illustrations. Even to those who use the arm but little, the practical discussion of its many points possesses much interest, and we believe that this work will be widely appreciated.

SCIENTIFIC AMERICAN BUILDING EDITION.

FEBRUARY NUMBER.—(No. 76.)

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1. Elegant plate in colors of a cottage at Short Hills, N. J. Estimated cost, $5,000. Perspective elevation, floor plans, etc.
2. Colored plate illustrating a cottage at Great Diamond Island, Me., erected at a cost of $900, complete. Floor plans, elevations, etc.
3. A residence at Portland, Me. Cost, $11,000 complete in every respect. Floor plans, perspective elevation, etc.
4. The very attractive residence of E. T. Burrows, Esq., at Portland, Me. Cost, $9,500 complete. Perspective elevation, floor plans, etc.
5. A dwelling at Augusta, Me., erected at a cost of $3,200 complete. Floor plans and perspective elevation.
6. A handsome dwelling at Carthage, Ill., designed in the style of modern Romanesque. Cost, $8,000. Perspective and floor plans.
7. A residence colonial in treatment and recently erected at Belle Haven, Greenwich, Conn., for Mr. Chas. A. Moore, at a cost of $14,000 complete. Two perspective elevations, floor plans, etc.
8. A colonial residence recently erected at Brookline, Mass., at a cost of $18,000 complete. Wm. T. Sears, architect, Boston, Mass. Perspective elevation and floor plans.
9. An architect's home, with sketches showing the hall, drawing room, terrace, entrance front, dining room, together with ground plan. A thoroughly cozy, comfortable, and complete dwelling.
10. Sketch for a suburban chapel. Submitted by O. M. Hokanson in the St. Paul Architectural Sketch Club competition.
11. View of the Washington Street tunnel at Chicago.
12. Miscellaneous contents: Architecture and poetry.—Waterproof wall coatings.—Colored woods.—The planning and construction of American frame houses.—Church spires.—Ownership of plans.—Simplicity in furnishing and decorating.—Utility and art. Improved door hanger, illustrated.—The Madison Square Garden weather vane, the huntress Diana, illustrated.—Schmidt's window frame, illustrated.—Sackett's wall and ceiling board.—An improved mitering machine, illustrated.—A combination folding bath tub, illustrated.—Japanese interiors.

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For Sale—One cupalo, one steel blower, one cast iron rattler. All in first class order and at low prices. W. P. Davis, Rochester, N. Y.

Acme engine, 1 to 5 H. P. See adv. next issue.

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Patent Open-Side Planing and Shaping Machines. Pedrick & Ayer, Philadelphia, Pa.

Wanted Cheap for Cash—Patent Office Gazette for last 10 years. R. D. Morgan, 1581 B'way, Cleveland, O.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3987) C. W. L. writes: In your issue of December 26 you give a translation of a method of cutting a five-pointed star, taken from *L'Illustration*. There is an error in the method as indicated which will result in a star deficient in a portion of one point. The cutting line should not run to point E, as there given, but to point, B, falling on line C E. The greatest economy of paper will result when the paper has the proportion of about one to two, and the point, B, is made to be on the upper edge, A, the other conditions remaining as before.

(3988) L. A. J. asks: Two bullets of same weight, fired with the same charge of powder out of the same rifle, and under the same conditions; one from, and in the direction of, a train moving at the rate of 40 miles an hour; the other from the rifle when stationary: 1. Will either bullet be carried further than the other? A. Yes. 2. If so, which one? A. The one from moving car.

(3989) H. M. C. asks: 1. Which one of the following batteries is the best for running small motors—the Edison-Lalande, the Fuller, or the bichromate plunge? Is there any one better than these? A. Where compactness and portability are required, the bichromate battery is probably the best. 2. How many cells would be required to run a six volt one-sixth horse power motor to its full capacity? A. Four to six good sized cells. 3. About how fast would such a motor drive a sixteen foot boat, rather lightly built? What would be the proper size propeller? A. Probably three to four miles per hour. 4. Is there any action in the Fuller battery when the circuit is open? A. Practically none.

(3990) C. A. Z. says: 1. I have noticed that different coins have not the same initials inscribed on them. Some have the letter O, others the letters C C, and again the letters S S are found on others. Could you tell me to what cities these letters refer? A. The coinage of the Philadelphia mint has no designating letter. O is New Orleans mint; C C, Carson City mint; S, San Francisco; C and D on old coinage is Charlotte and Dahloneg mint, now discontinued. 2. Could you tell me the value of a cent of 1802 and of

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a dollar of 1804? Also, how many dollars were coined in the year 1804? A. Address Superintendent of the Mint, Philadelphia, in regard to value and coinage.

(3991) G. M. W. says: 1. I want a metal that I can heat mercury or quicksilver in, to about 500° or 600° F., that the mercury will not injure or that will not injure the mercury. Will steel do? Or is there any way of preparing steel so it will do? A. Steel or wrought iron tubing is the best to hold mercury, requiring no preparation. There is no reaction by either metal on the other. 2. How much pressure would a flue about three-eighths inch inside and five-eighths inch outside stand before it would collapse? The flue to be made of steel or whatever other metal you advise using. I want one that will stand the greatest possible pressure. A. Three-eighths inch gas pipe, if properly welded, is good for pressures up to 3,000 pounds to the square inch, and three-eighths inch extra strong is good for 6,000 lb. per square inch. 3. How thick would I require the metal of a cylinder 6 inches diameter inside to be, to stand same pressure? A. Six inch wrought iron pipe should be equal to a working pressure of 1,500 lb., and extra strong 6 inch equal to 3,000 lb. For these working pressures, the pipe should be tested to 50 per cent higher pressure. 4. Please tell me how much mercury expands with heat. Say 100 cubic inches at 0° F. How much would there be at 300° F., also at 600° F.? A. One volume of mercury at zero becomes 1·0256 at 300° F. and 1·0313 at 600°.

(3992) B. E. W., Antonio, Kans., writes: I want to make for my own use a four or five inch astronomical telescope, with eyepiece for terrestrial use. Have had over four years' experience as a mechanic on fine and close bench work; have good eyesight and very delicate sense of touch. If you think it possible for me to grind and polish the lens, would ask as follows: 1. Where can I get the roughly ground glass castings for same, and at what price (for achromatic lens)? 2. Where can I get the material and gauges for grinding and polishing, and at what price? 3. Would it be better to buy eyepieces (celestial and terrestrial) already mounted in cell, or could I get separate ready ground lens and make them? 4. What standard work on the subject could I get that would aid me? A. There are large possibilities for amateurs with patience and perseverance. You can obtain the optical crown and flint glass from W. T. Gregg, optician, 122 Fulton Street, New York, cost about $2.50 per pound. You must make your own gauges and laps. You can buy eyepieces cheaper than to make them. You will find full instructions for grinding and polishing lenses, with the curves and kind of glass for telescope object glasses, illustrated in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 581, 582, 583. Also illustrations and construction of various eyepieces, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 399, 10 cents each mailed. Byrne's "Hand Book for the Mechanic and Artisan" contains much information on grinding and polishing lenses. By mail, $5.

(3993) S. E. asks: 1. Can you inform me what the capacity is of the largest air pumps, not fans, in actual operation, and where, and about the size of their cylinders? A. The largest air pumps are the blowing engines of blast furnaces, with cylinders 6 to 8 feet diameter and 10 feet stroke, used in Pennsylvania. 2. Also have we any examples of suspension bridges whose suspending cables pass over more than two piers; if not, what is the first most serious objection (if any), or has this plan never been agitated? A. The suspension aqueduct at Pittsburg has seven spans. There are other suspension bridges of more than two suspending piers. We do not recall their names. There is no objection where it is necessary to have more than two piers, if proper trussing is used to prevent undulation.

(3994) A. M. says: Assuming that the wood is steamed and bent when green, and allowed time for the wood to be thoroughly seasoned and set in the bend, would it be inclined to lose the shape or curve if exposed to damp? If so, do you know of any process of rendering the wood damp-proof? A. Bent wood tends to resume its original shape when exposed to damp or becomes wet. The only way to prevent it is to finish and oil or varnish the bent wood, so as to prevent changes in its hygrometric condition.

(3995) J. H. G. asks what to use to wash brass or copper to give it a silver coating. I used to use a wash composed of quicksilver, sulphuric acid and rain water, but have forgotten the proportions. A. The process is to dissolve a small quantity of mercury in a solution of one part nitric acid to four parts water until it is saturated. Pour off the saturated solution, and to an ounce of the solution add a few drops of hydrochloric acid diluted with four parts water until a bright piece of copper is whitened by being dipped. Then dip any article, or rub the solution on it and wash.

(3996) D. R. C. says: I wish to paint the brick walls of a composing room, used for setting type, and also the rough hemlock joists under the roof with some white substance that will not scale off and fall into the type. Please state in the SCIENTIFIC AMERICAN what composition would be best for this purpose. Would like something not very expensive. A. We can recommend a whitewash made in the proportion of one-half a bushel of best lime slaked in hot water, eight quarts salt dissolved in hot water, 2½ lb. rice meal boiled to a paste, to which add one-half a pound white glue previously dissolved and one-half a pound clear whiting. Add the salt brine to the slaked lime and then the other ingredients. Keep it hot while using. Use a whitewash brush. Woodwork should be thoroughly cleaned from dust before applying this whitewash. It makes a bright surface like paint.

(3997) W. P. asks: How can I harden the tips or points of cog wheels, say to a depth of not more than one sixteenth of an inch? Said wheels are about 4 inches in diameter by half inch wide (or thick). The material is crucible cast steel. A. We suggest placing the gear on a revolving spindle at the proper heat, and to quickly bring a jet of water to bear upon the teeth. Speed should be about 600 revolutions per minute. Have the jet half an inch diameter, and under 20 or 30 lb. pressure. This will harden the teeth only. Steel should be as low in carbon as is compatible with hardening, to prevent cracking of the teeth.

(3998) Reader asks: 1. In what SUPPLEMENTS are the directions for making dynamos, motors, and telephones? A. We refer you to SUPPLEMENT, Nos. 161, 600, 720, 793, for dynamos; to Nos. 641, 759, 767, 783, for motors; and to Nos. 142, 163, 250, for telephones. 2. What are the formulas (chemical) for cutting copper and zinc? A. Use nitric acid for copper. Sulphuric, hydrochloric or nitric acid will dissolve zinc. 3. Is there any way I can get a catalogue from electrical firms without asking each one directly? A. You might make known your wants by advertising. 4. In wrapping an induction coil 3½ inch the primary layers are to the secondary as 3 : 10. What is the ratio for coils increasing an inch each time, using wire 18 and 32? A. The E.M.F. of the secondary is to that of the primary as the number of turns in the secondary is to the number of turns in the primary, while the amperage in the secondary is in inverse proportion to the E.M.F. For an answer to your medical query we advise you to consult a physician.

(3999) J. M. M. asks: How much does a bar of railroad track expand and contract in length, and how much space ought to be between the ends or joints? A. Rails vary in length by the extreme temperatures in the United States, about one-quarter of an inch in 20 feet, and for 30 feet rails about 7-16 of an inch, so that rails laid at time of mean temperature in the Northern States should have half the above spaces between the ends; in the Southern States, one-quarter. Rail laid in summer in the Southern States may have an allowance of 1-16 inch in 20 feet rails, and 3-16 inch in 30 feet rails.

(4000) M. C. A. C. asks: 1. How to keep linoleum bright. A. Wash with equal quantities of milk and water. Once in several months a little linseed oil or a weak solution of beeswax in spirits of turpentine may be used. 2. How are face powders perfumed? A. Use a few drops of some essential oil, as bergamot. Keep the powder in an air-tight jar.

(4001) F. E. W. asks: 1. Of what material are graphite bearings made, so that they require no oil? A. Graphite freed from grit. 2. Which kind of a wind engine (or mill) is the most serviceable—with or without cog gearing? A. Consult our advertising columns for a reply to this query.

(4002) M. R. asks: Will you please tell me if a common battery of blue vitriol and water, with a copper and zinc, will light a two, three, or four incandescent lamp, and how many cells would it take, and where could I get the lamps, or what kind of a battery does it take? A. A gravity battery is of no use in electric lighting. It is sometimes employed for charging secondary batteries, and the latter are used for operating lamps. The secondary battery is the best for lighting purposes.

(4003) F. V. C. asks: 1. Is there any cheap substitute for the porous cups that come in batteries? A. Nothing very efficient. Try flower pots with the holes corked up. 2. What kind of battery is best for a motor? What for a storage battery? A. Storage battery for motors, and gravity batteries for charging the storage batteries. 3. Tell how to make the principal parts of a storage battery, and its dimensions, when used for lighting. A. For this information see SCIENTIFIC AMERICAN, vol. lxi., page 22. 4. Describe a small compressed air motor run by a power of 30 lb. per square inch from a small water pipe. A. A small compressed air motor is substantially the same as a steam engine. 5. What acid is used to reduce soft wood to pulp? Can it then be brought back to a hard substance? A. Nitric and sulphuric. By proper treatment the wood is converted into cellulose, which is explosive. It can be dissolved in a mixture of alcohol and ether, and will solidify on drying.

(4004) W. T. says: Can you inform me about what per cent of heat contained in anthracite coal, burned in a stove made for heating only, can be liberated into a room, or can you tell me whether there is necessarily a loss of 50 per cent or over, under the most favorable conditions? A. The loss of heat in common stoves may be as great as 50 per cent, but with the best stoves, provided with large absorbing and radiating surface, the loss should not be greater than 25 per cent, and much of this might be saved by extending the stovepipe, so as to utilize all the heat, save enough to create draught. Much of the heat is also lost by opening stove doors for ventilation.

(4005) W. L. J. asks: Would a 500 lb. ball, say, fired from a gun in a perpendicular position, with a charge of powder sufficient to throw it vertically say five miles, return to the earth with the same velocity with which it started? A. It would not. The friction of the air materially retards its velocity, due to gravity.

(4006) H. H. S. says: 1. I have a 2 inch pipe, 1 foot under ground, 75 yards in length, which drains a creamer; am bothered with it becoming filled with something that obstructs the flow of water. Give me a solution to clean it. A. If the pipe is foul from the drainage matter, use a strong solution of caustic potash, not soda, in boiling hot water. If necessary, stop the end of the pipe while the hot lye is running, fill the pipe, and let it remain over night. 2. I want to know the proper side to run a leather belt, in regard to the splices, that is, ought the end of the splice or lap butt the face of the pulley? A. The belt ends should be butted together and laced to make a smooth surface. If put together with hooks, the butts should turn out. 3. Can a cell of Burnley dry battery receive a new life from a dynamo? A. A dry battery cannot be charged by a dynamo.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the number therein given:

(3842) Referring to SCIENTIFIC AMERICAN of January 9, 1892, question 3842, C. B. can clean his brass rifle or shot shells by immersing them in strong cider vinegar, and heat to a boil. Then rinse them thoroughly in clear cold water, and wipe dry with woolen cloth. If the vinegar is good, the shells will be clean and will remain so.—G. E. K.

M. T. D. asks how to pickle beef, tongues, etc.—A. P. S. asks how to make invisible or sympathetic ink.—C. A. W. asks for a corn salve.—W. H. E. asks for a harness grease.—E. S. S. asks for a shoe blacking or polish.—R. W. S. asks how to make a hektograph or copying pad.—E. R. T. asks how to tin iron.—J. A. B. asks (1) for a receipt for making a cement which will stick leather to metal. 2. How to estimate horse power of an engine.—J. H. S. asks how to remove tattooing.—H. F. C. asks how to make birdlime.—Y. M. C. A. asks (1) how to etch glass, (2) names of all known elements and metals.

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column. A new circular is now ready.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

January 26, 1892,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abundi, R., T. Ellis, Jr., & J. T. Sackett, Kansas City, Mo., suppository 467,599
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Adams, D. C., Toronto, Can., smoke consumer 467,745
Aigler, D., St. Louis, Mo., mashing potatoes 467,488
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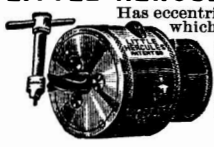
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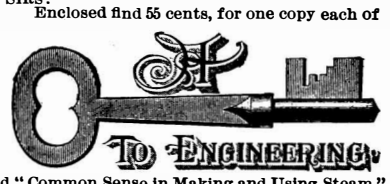

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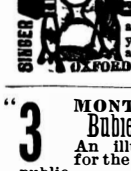

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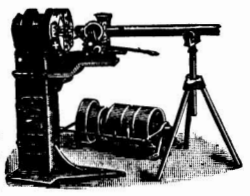
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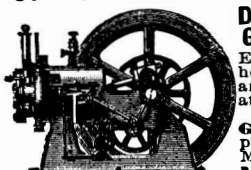
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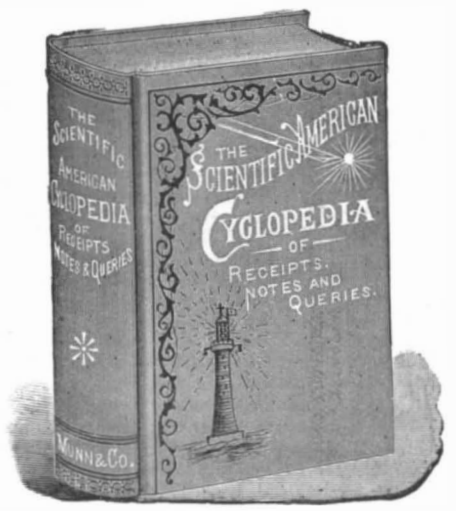

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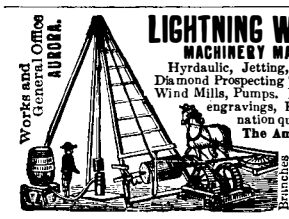

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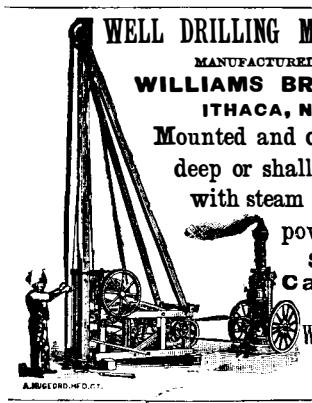

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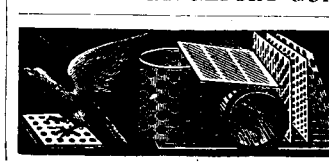

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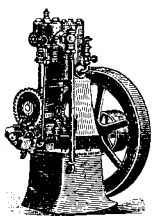

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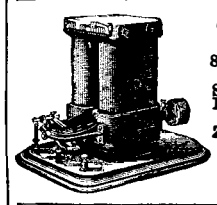

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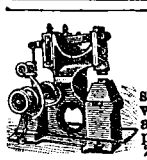

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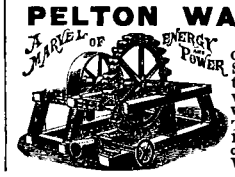

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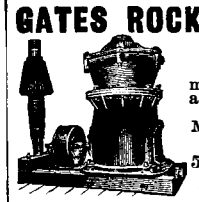

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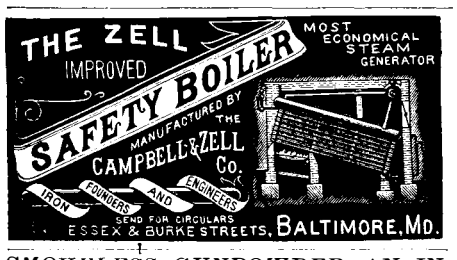

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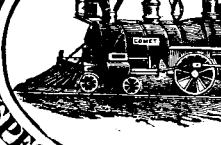

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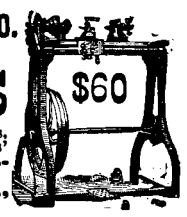

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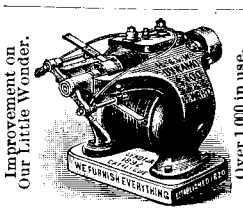

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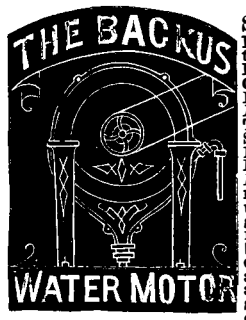

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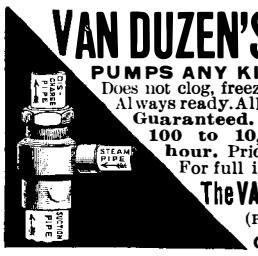

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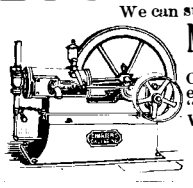

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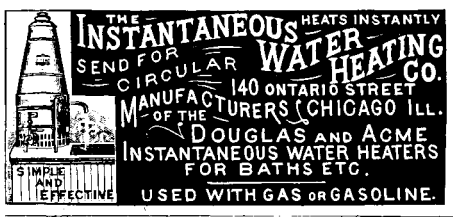
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